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Final Site Inspection Narrative Report

Penniman Shell Loading Plant
Williamsburg, Virginia

9 August 1999

Prepared for
U.S. Environmental Protection Agency Region III
Federal Facilities Section
Philadelphia, PA

SATA
Site Assessment
Technical Assistance

TDD No. 9901-45
Contract No. 68-S5-3002

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1.0 INTRODUCTION

Under the authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 and the Superfund Amendments and Reauthorization Act (SARA) of 1986, the U.S. Environmental Protection Agency (EPA) Region III Remedial Response Section, Remedial Project Manager Robert Thomson directed the Roy F. Weston, Inc. (WESTON®), Site Assessment Technical Assistance (SATA) team to conduct a sampling event at the Penniman Shell Loading Plant Site, Williamsburg, York County, Virginia. The purpose of this investigation was to collect information concerning conditions at the Penniman Shell Loading Plant Site sufficient to assess the potential contamination sources present at this site and to determine the need for additional investigation under CERCLA or other authority and, if appropriate, support site evaluation using the Hazard Ranking System (HRS) for proposal to the National Priorities List (NPL). The investigation included reviewing background information, sampling waste and environmental media, evaluating and documenting HRS factors, and collecting additional non-sampling information.

A total of 29 samples were collected as part of the sampling event, including fourteen waste source samples, nine sediment samples, two surface water samples, one drinking water sample, three background samples, and all associated QA/QC samples. All samples were sent to EPA CLP arranged laboratories, where they were analyzed for complete organic and inorganic Contract Laboratory Program (CLP) parameters using CLP laboratory protocols. In addition, the drinking water sample was sent to a Delivery of Analytical Services (DAS) arranged laboratory where it was analyzed for low concentration CLP Target Analyte List (TAL) inorganic and to a CLP arranged laboratory where it was analyzed for low concentration CLP organic parameters. Soil and sediment samples were also analyzed for nitroaromatic compounds (EPA SW-846) by a DAS arranged laboratory. Two soil samples were also analyzed for mustard decomposition products using U.S. Army Treaty Laboratory APG-SOPs by a DAS arranged laboratory. A summary of the analytical results received from the laboratory for the January 1999 sampling event are found in Attachment 1 of this report.

This sampling event was conducted as part of the scope of work specified in Work Plan 1.0, dated 19 March 1998, prepared by SATA, and approved by EPA.

2.0 BACKGROUND

2.1 Site Location

The site is located just north of Williamsburg, York County, Virginia as illustrated in Figure 1, Site Location Map (Reference 1). The approximate site coordinates are 37° 17' 30" north latitude and 76° 37' 30" west longitude (Reference 1).

2.2 Site Description

The Penniman Shell Loading Plant Site (the site) consists of approximately four thousand acres just outside of Williamsburg, York County, Virginia (Reference 2). The site is currently divided between the United States Navy (USN) Supply Center Cheatham Annex (CAX), the United States Department of the Interior (DOI) National Park Service (National Colonial Park), and the Virginia Department of Emergency Services (VADES) (Fuel Farm) (Reference 2). All of these parcels were, at one time, utilized for the manufacturing, storage, and shipment of explosives and military ordnance as far back as 1916 (Reference 3). The site is bordered by the U.S. Army Camp Peary to the north, the United States Naval Weapons Station to the south, the York River to the east, and the Busch Gardens Amusement Park to the west.

Four waste source areas on the site have been identified utilizing aerial photographs, engineering drawings, and historical information. These areas have been confirmed through site reconnaissance visits and USN or VADEQ representatives (References 4 and 5).

A landfill area, approximately 54,615 square feet (1.25 acres) in size, is located on USN property along Penniman Road near the Jones Pond water treatment facility. Reconnaissance walks in this area have identified gas cylinders, steel drums, construction debris, and various other types of wastes. The age of this landfill area is currently unknown, but there is evidence that at least some of the debris in this area dates to the World War I era (Reference 6). Runoff from this area flows approximately 1,000 feet into Jones Pond, which is the drinking water supply for USN CAX. The depth and groundwater containment factor for this landfill are unknown, although there does not appear to be any significant containment. This landfill is restricted from the general public by a locked chain link fence; however, it is unrestricted to Navy personnel who utilize Jones Pond for recreation and fishing. Since it is located behind the dam which forms Jones Pond, this landfill is located in Federal Emergency Management Agency (FEMA) Flood Zone X, which is designated as other areas outside of the 500-year flood plain (Reference 7).

A trinitrotoluene (TNT) production area, approximately 18,874,474 square feet (433.3 acres) in size, is located north of Sanda Avenue (formerly DuPont's "D" plant) on USN and DOI property (see Figure 2, Former DuPont "D" Plant Map). This area consists of 24 earthen bunkers, identified on engineering drawings dated 1916 as nitro-starch dry houses, nitro-starch dry stores, dynamite mix houses, 4.7-inch shell loading lines, 3-inch shell loading lines, and pack houses (Reference 8). Runoff from this area flows through man made ditches into Cheatham Pond, a fishery. The shortest overland distance from one of these sources to Cheatham Pond is 40 feet (Reference 5). The groundwater containment factor for these sources is unknown; however, they all have earthen floors. Based upon site reconnaissance performed by SATA, there does not appear to be any restriction to contaminants entering the groundwater (Reference 5).



LEGEND

- UNDERGROUND WATER LINE
- PROPERTY BORDER
- RAILROAD
- ROADWAY - WIDTH
VARIES BY ROAD DUTY
- STRUCTURE
- BUNKER - EXACT
DESIGN VARIES
- GROUND FEATURE
FROM AERIAL PHOTO
(LABELED)
- TRAM CAR RAILS
- 3
- UNDERGROUND FUEL TANKS
- ABOVE GROUND TANKS
- BRIDGE OR TRESTLE
- STEEL
- USN, DuPont, or PENNINGTON
ENGINEERING SHEET NUMBER

Cyan indicates former Penniman structures.
Black indicates current conditions.

THE SOURCES OF THIS MAP INCLUDE U.S. NAVY, DaPONT, PENNMAN, COMMONWEALTH OF VIRGINIA, AND OTHER ENGINEERING, SURVEY, AND TOPOGRAPHICAL MAPS. IN ADDITION, U.S. AERIAL PHOTOGRAPHS WERE ELECTRONICALLY DIGITIZED AND OVERLAYED ONTO THIS BASE MAP. SOME OF THIS DATA DATES TO 1916, AND THE DIGITIZATION OF AERIAL PHOTOGRAPHS IS SUBJECT TO MAJOR ERRORS. THE RESULT OF WEATHER AND LIGHTING CONDITIONS. THEREFORE, THE INFORMATION ON THIS MAP SHOULD BE CONSIDERED APPROXIMATE.

1.	1/5/99	RM	Added Kendall layer - 1918 phonetic interpretation (12/98)				
2.	1/5/99	RM	Changed title to reflect new information				
3.	1/22/99	RM	Added dirt roads surveyed on 1/12-13/99				
4.	1/27/99	RM	Added 1/99 samples, changed layer colors				
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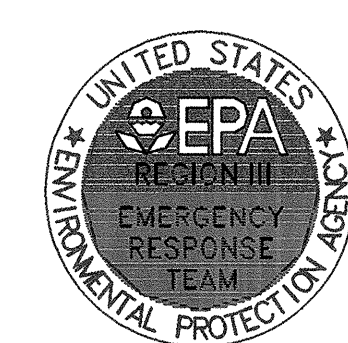
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DELRAN *NEW JERSEY*

RPM	Robert Thomson
SATA LEAD	Robert McClade
PROJ. ENG.	
APPR.	
FILE NAME	SATA000135:/Sites/Cheatham/ SATAAUTOCAD/SIMaps/cheatham5.dwg




PENNIMAN SHELL LOADING PLANT
DuPONT'S "D" PLANT AND TNT PLANT

<i>WILLIAMSBURG</i>		<i>VIRGINIA</i>
<i>DRAWN BY</i> <i>ROBERT McGLADE</i>	<i>DATE</i> <i>17 JULY 1998</i>	<i>DWG. NO.</i> <i>ONE</i>
<i>SCALE</i> <i>AS INDICATED</i>	<i>PCS NO.</i> <i>4381</i>	<i>SHT. <u>2</u> OF <u>3</u></i>

SCALE IN FEET

250



0 500

APPROXIMATE

FIGURE 2. FORMER DuPONT "D" PLANT MAP

All of these sources are located within FEMA Flood Zone X (Reference 7).

A shell loading area, approximately 11,245,924 square feet (258.2 acres) in size, is located south of Sanda Avenue (formerly DuPont's "G" plant) on USN property (see Figure 3, Former DuPont "G" Plant Map). A portion of this area includes eight concrete structures dating from 1916 (gauge pouring houses) which are currently utilized by the USN for storage. The remainder of this area is overgrown and includes the 9.5-inch shell loading lines, 155-millimeter shell loading lines, and 75-millimeter shell loading lines; however, many of the foundations dating to 1916 still remain. Runoff from this area flows through manmade ditches and overland into King Creek and Penniman Lake. The shortest overland flow from one of these sources into King Creek is approximately 100 feet, and the shortest overland flow from one of these sources into Penniman Lake is approximately 20 feet (Reference 5). Two of the sources identified in this area (TNT Catch Boxes and Ammonia Settling Pits) are located within FEMA Flood Zone AE, which is identified as "special flood hazard areas within the 100-year flood plain with base flood elevations determined" (Reference 7). All of the other sources in this area are located within FEMA Flood Zone X (Reference 7).

The groundwater containment factors for these sources in the shell loading area are unknown, although most have earthen floors and no significant containment (marked with asterisks in the list below). Foundations which have been positively identified during site reconnaissance visits in this area include (Reference 8):

- TNT graining house.
- Ammonia evaporating building.*
- Ammonia finishing building.*
- Shipping houses.*
- TNT and tetryl daily storage bunker.*
- TNT daily storage bunker.*
- Booster test pit.
- Assembly houses.*
- Conveyors.*
- Empty shell storage houses.*
- Paint storage houses.*

A shipping area, approximately 22,441,566 square feet (515.2 acres) in size, is located on DOI property to the north of USN CAX. This area includes several roadways built on old rail beds and tram car lines, one building identified in 1916 engineering drawings as finished ammunition magazine #6, numerous "blast" holes, and a metal drum suspected to be an FM smoke drum which may date from the World War I era (Reference 6). Runoff from this area flows overland into Cheatham Pond, and the shortest overland distance from the sources in this area to Cheatham Pond is approximately 1,000 feet (Reference 1).



LEGEND

UNDERGROUND WATER LINE

PROPERTY BORDER

RAILROAD

ROADWAY - WIDTH VARIES BY ROAD DUTY

STRUCTURE

BUNKER - EXACT DESIGN VARIES

GROUND FEATURE FROM AERIAL PHOTO (LABELED)

TRAM CAR RAILS

UNDERGROUND FUEL TANKS

ABOVE GROUND TANKS

BRIDGE OR TRESTLE

U.S. DuPONT, or PENNIMAN ENGINEERING SHEET NUMBER

Cyan indicates former Penniman structures.

Black indicates current conditions.

THE SOURCES OF THIS MAP INCLUDE U.S. NAVY, DuPONT, PENNIMAN, COMMONWEALTH OF VIRGINIA, AND OTHER ENGINEERING, SURVEY, AND TOPOGRAPHICAL MAPS. IN ADDITION, U.S. EPA AERIAL PHOTOGRAPHS WERE ELECTRONICALLY DIGITIZED AND OVERLAYED ONTO THIS BASE MAP. SOME OF THIS DATA DATES TO 1916, AND THE DIGITIZATION OF AERIAL PHOTOGRAPHS IS SUBJECT TO MINOR ERRORS AS THE RESULT OF WEATHER AND LIGHTING CONDITIONS. THEREFORE, THE INFORMATION ON THIS MAP SHOULD BE CONSIDERED APPROXIMATE.

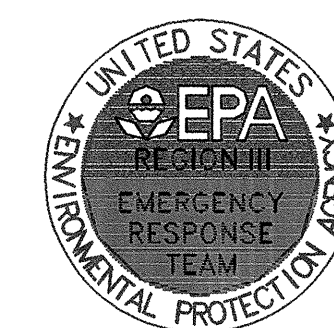
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2. 1/6/99	RM	Changed title to reflect new information					
3. 1/22/99	RM	Added dirt roads surveyed on 1/12-13/99					
4. 1/27/99	RM	Added 1/99 samples, changed layer colors					
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WESTON FEDERAL PROGRAMS DIVISION

DELRAN MANAGERS DESIGNERS/CONSULTANTS NEW JERSEY

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PENNIMAN SHELL LOADING PLANT DuPONT'S PENNIMAN "G" PLANT

WILLIAMSBURG VIRGINIA		
DRAWN BY	DATE	DWG. NO.
ROBERT MCGLADE	17 JULY 1998	ONE
SCALE	P.C.S. NO.	
AS INDICATED	4381	SHT. 3 OF 3

SCALE IN FEET

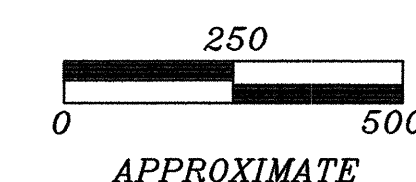


FIGURE 3. FORMER DuPONT "G" PLANT MAP

2.3 Operational History and Waste Characteristics

The Penniman Shell Loading Plant was an explosives manufacturing facility operated by the DuPont de Nemours Company on what is now the USN CAX and the National Colonial Park properties. According to historical information, this facility operated as a TNT manufacturing plant beginning in approximately 1916, and subsequently began loading artillery shells for the war effort in 1918 (References 3, 10, and 11). Between 1918 and 1925, following the end of World War I, this facility was demolished and reverted to farmland (Reference 3). The United States Navy established the Cheatham Annex Supply Center on a portion of this property in 1942 (Reference 9).

A fuel storage depot was operated by the USN from approximately 1942 until the mid 1980s, at which time the property was purchased by the VADES. VADES conducted a sampling assessment of the site, which identified areas of total petroleum hydrocarbon (TPH), polychlorinated biphenyl (PCB), and asbestos contamination (Reference 12). A corrective actions plan was developed for the site, and corrective actions were initiated by VADES. According to VADES, all identified PCB and asbestos contamination was removed. In the early 1990s, the fuel storage tanks were pumped and cleaned (Reference 12).

All of the properties, with the exception of the DOI parcel, are secured with fencing. Since the DOI parcel is a national park, its access is unrestricted. The contaminants of concern at the site (currently at the USN CAX and DOI parcels) are primarily those associated with military activities and the manufacturing of explosives.

SATA conducted a site reconnaissance in September 1998 to identify specific sampling locations for this sampling event. A sampling plan was prepared by SATA in October 1998 and approved by the EPA. Conflicts with deer hunting season on USN CAX and DOI property delayed sampling until 11 January 1999, as requested by the US Navy.

3.0 WASTE SOURCE SAMPLING

3.1 Sample Locations

The potential waste sources for the site were identified through a thorough interpretation of historical aerial photographs dating from 1937 to 1998, engineering drawings dating from 1916, and site reconnaissance visits (References 4, 5, and 8). The potential waste sources include a TNT manufacturing area (nitro-starch dry houses), a shell loading area (TNT graining house, TNT catch boxes, ammonia evaporating house, a mixing tank, a storm drain mixer, a waste barrel storage area, and a slag area), a landfill area, and a shipping/magazine area (blast holes and an unknown drum suspected to have once contained the chemical agent FM smoke).

Table 1 presents the waste sources sampled during the January 1999 sampling event, and includes the waste source description, associated sample numbers, associated contaminants, and size. Attachment 1 presents the sample numbers, locations, and objectives for all samples collected during the sampling event. Figures 4 and 5, Sample Location Maps #1 and #2, respectively, graphically depict the sample locations presented in Table 1, as well as those presented in Attachment 1.

Table 1
Waste Source Descriptions

Waste Source #	Waste Source Description	Samples Associated with Waste Source	Contaminants and Analytical Results Associated with Waste Source	Size of Source
1	Earthen ammonia settling pits to the north of the ammonia finishing building. It is believed that wastewater from the ammonia finishing building was discharged through these settling pits and into Penniman Lake, which is approximately 20 feet away.	PEN1-SO-01	Arsenic (6 mg/kg) Observed contamination through sampling.	3 pits, each 10 feet in diameter = 235.61 sq. ft.
2	TNT graining house sump. This concrete-lined, open top pit is believed to be the sump pit for the TNT graining house. This open sump is located approximately 25 feet from Penniman Lake.	PEN1-SO-03 PEN1-SO-03A	2,4,6-TNT (28 mg/kg) Arsenic (15.5 mg/kg) Cadmium (4 mg/kg) Lead (7580 mg/kg) Manganese (886 mg/kg) Observed contamination through sampling.	6 ft. long x 3 ft. wide = 18 sq. ft.
3	TNT catch box ruins. This earthen, brick-lined depression is located immediately adjacent to the TNT graining house, and is believed to have been used to separate TNT particles from wastewater prior to being discharged into Penniman Lake.	PEN1-SO-04	2,4,6-TNT (620 mg/kg) Arsenic (11 mg/kg) Lead (813 mg/kg) Observed contamination through sampling.	15 ft. long x 6 ft. wide = 90 sq. ft.

Table 1
Waste Source Descriptions

Waste Source #	Waste Source Description	Samples Associated with Waste Source	Contaminants and Analytical Results Associated with Waste Source	Size of Source
4	Storm drain mixer openings. This 1-foot diameter, underground steel pipe with openings to the surface is located between the TNT graining house and the ammonia evaporating building. It was speculated by the WESTON ordnance expert that these openings may have been utilized to neutralize wastewater in situ as it passed through this pipe.	PEN1-SO-05	Arsenic (3.5 mg/kg) Observed contamination through sampling.	20 ft. long (estimated) x 1 ft. in diameter = 94.245 cu. ft.
5	Underground mixing tank. This steel, underground tank with mixing paddles is located to the north of the paint storage buildings near the 75-mm lines. The use of this mixing tank is unknown.	PEN1-SO-06	Arsenic (17.9 mg/kg) Lead (1,720 mg/kg) Manganese (344 J mg/kg)	12 ft. long x 3 ft. in diameter = 339.28 cu. ft.
6	Metallic slag material which is located throughout the site. NPS employee speculated that this material might be slag broken out of the boilers of the steam locomotives along the rail lines by engineers during operations at the shell loading plant.	PEN1-SO-07	Antimony (4.6 L mg/kg) Arsenic (33.4 mg/kg) Chromium (32.9 mg/kg) Lead (2,600 mg/kg) Manganese (2,070 J mg/kg) Observed contamination through sampling.	Located throughout the site. Sampled area was 25 ft. long x 10 ft. wide = 250 sq. ft.
7	Soil beneath and around the FM/FS smoke drum. The samples for this waste source were collected from an area of dead vegetation, 6-12 inches in depth.	PEN1-SO-09 PEN1-SO-10	Arsenic (3.5 mg/kg) Observed contamination through sampling.	35 ft. long x 15 ft. wide x 0.5 ft. deep = 262.5 cu. Ft.
8	Large blast holes. There are over 100 blast holes, based upon aerial photographs, in the magazine area of the site. These holes are speculated to have been caused from quality control test detonations of finished artillery during operation. These holes range in size from 10 feet to 25 feet in diameter and up to 6 feet deep.	PEN1-SO-11 PEN1-SO-12	Arsenic (11.9 mg/kg) Chromium (49.3 mg/kg) Observed contamination through sampling from 6 to 18 inches in depth.	100 holes @ 17.5 ft. (average) diameter 1 ft. deep = 17,500 cu. ft.

Table 1
Waste Source Descriptions

Waste Source #	Waste Source Description	Samples Associated with Waste Source	Contaminants and Analytical Results Associated with Waste Source	Size of Source
9	1918 Drum Storage Area. This area was used as drum storage during operation. The size and location of this waste source area was based upon a panoramic photograph of the Penniman Shell Loading Plant taken in 1918.	PEN1-SO-13 PEN1-SO-14	Arsenic (5.5 mg/kg) Observed contamination through sampling at 12 to 24 inches in depth.	200 ft. long x 50 ft. wide
10	Nitro-starch dry house sumps. These brick-lined sump pits are found in 8 of the 24 bunkers on DOI property.	PEN1-SED-06	Lead (52.5 mg/kg) Manganese (220 mg/kg)	8 each at 4 ft. long x 3 ft. wide = 96 sq. ft.

NOTE 1 - For waste sources with multiple samples, the highest levels of contaminants identified in any of the samples were used for this table.

NOTE 2 - Correction factors have been applied to "J" qualified data for comparison to background in accordance with EPA OSWER Directive #9285.7-14FS, July 1994.

NOTE 3 - Manganese compounds are regulated under CERCLA, manganese itself is not.

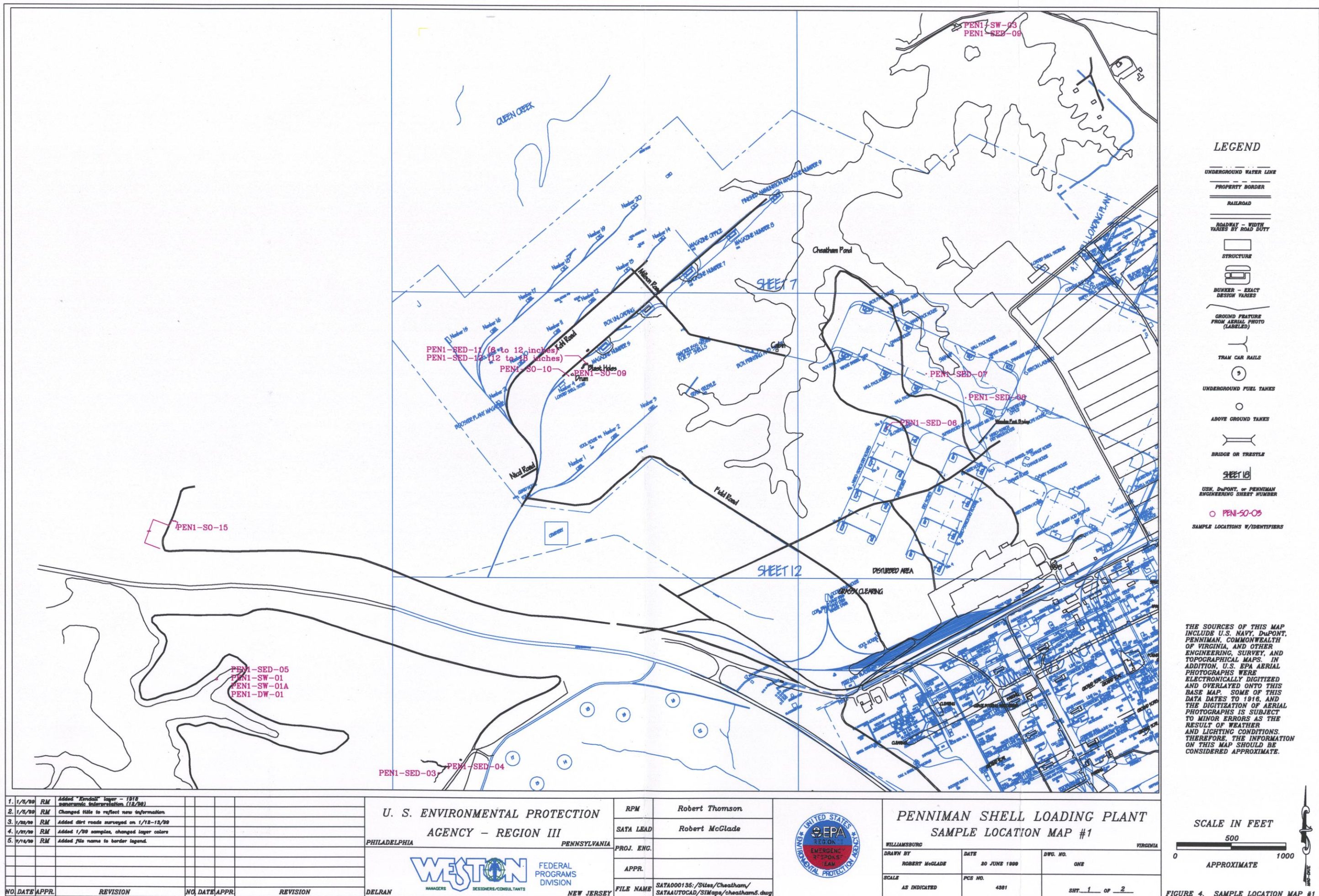
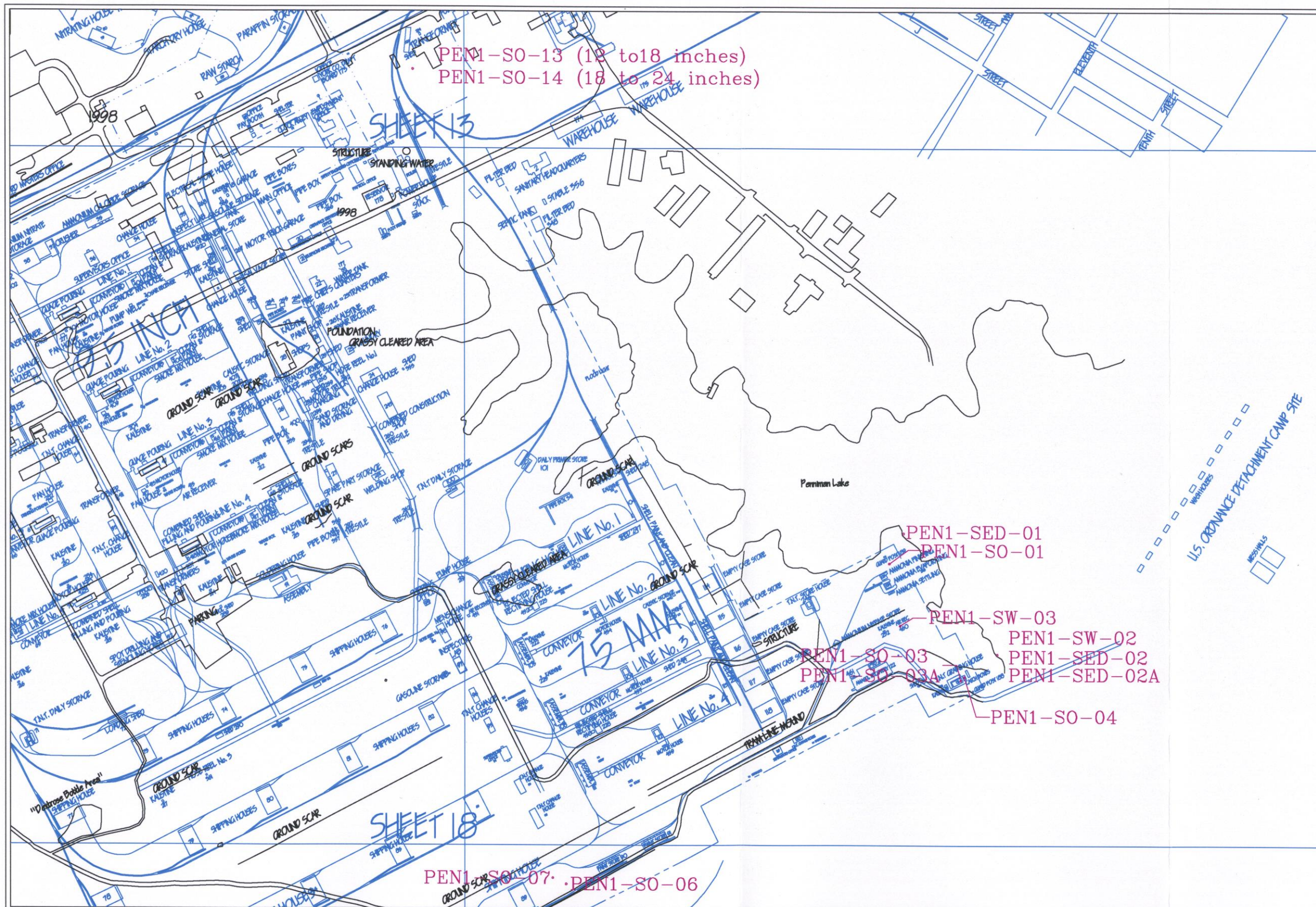


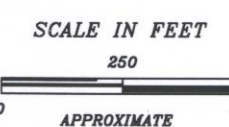
FIGURE 4. SAMPLE LOCATION MAP #1



LEGEND

- UNDERGROUND WATER LINE
- PROPERTY BORDER
- RAILROAD
- ROADWAY - WIDTH VARIES BY ROAD DUTY
- STRUCTURE
- BUICKER - EXACT DESIGN VARIES
- GROUND FEATURE FROM AERIAL PHOTO (LABELLED)
- TRAM CAR RAILS
- UNDERGROUND FUEL TANKS
- ABOVE GROUND TANKS
- BRIDGE OR TRESTLE
- SHEET 13
- USN, DuPont, or PENNIMAN ENGINEERING SHEET NUMBER
- PEN1-SO-03
- SAMPLE LOCATIONS W/IDENTIFIERS

THE SOURCES OF THIS MAP INCLUDE U.S. NAVY, DuPont, PENNIMAN, COMMONWEALTH OF VIRGINIA, AND OTHER ENGINEERING, SURVEY, AND TOPOGRAPHICAL MAPS. IN ADDITION, U.S. EPA AERIAL PHOTOGRAPHS WERE ELECTRONICALLY DIGITIZED AND OVERLAYED ONTO THIS BASE MAP. SOME OF THIS DATA DATES TO 1916, AND THE DIGITIZATION OF AERIAL PHOTOGRAPHS IS SUBJECT TO MINOR ERRORS AS THE RESULT OF WEATHER AND LIGHTING CONDITIONS. THEREFORE, THE INFORMATION ON THIS MAP SHOULD BE CONSIDERED APPROXIMATE.



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5. 1/5/99	RM	Added 1/99 samples, changed layer colors
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PHILADELPHIA PENNSYLVANIA

WESTON

FEDERAL PROGRAMS DIVISION

MANAGERS DESIGNERS/CONSULTANTS

NEW JERSEY

RPM Robert Thomson

SATA LEAD Robert McClade

PROJ. ENG.

APPR.

FILE NAME SATA000135:/Sites/Cheatham/SATAAUTOCAD/SIMaps/cheatham5.dwg

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION III

WILLIAMSBURG VIRGINIA

PENNIMAN SHELL LOADING PLANT

SAMPLE LOCATION MAP #2

WILLIAMSBURG VIRGINIA

DRAWN BY ROBERT McGLADE

DATE 20 JUNE 1999

DWG. NO. ONE

SCALE AS INDICATED

PCS NO. 4381

SHT. 2 OF 2

FIGURE 5. SAMPLE LOCATION MAP #2

All of these sources are located within FEMA Flood Zone X (Reference 7).

A shell loading area, approximately 11,245,924 square feet (258.2 acres) in size, is located south of Sanda Avenue (formerly DuPont's "G" plant) on USN property (see Figure 3, Former DuPont "G" Plant Map). A portion of this area includes eight concrete structures dating from 1916 (gauge pouring houses) which are currently utilized by the USN for storage. The remainder of this area is overgrown and includes the 9.5-inch shell loading lines, 155-millimeter shell loading lines, and 75-millimeter shell loading lines; however, many of the foundations dating to 1916 still remain. Runoff from this area flows through manmade ditches and overland into King Creek and Penniman Lake. The shortest overland flow from one of these sources into King Creek is approximately 100 feet, and the shortest overland flow from one of these sources into Penniman Lake is approximately 20 feet (Reference 5). Two of the sources identified in this area (TNT Catch Boxes and Ammonia Settling Pits) are located within FEMA Flood Zone AE, which is identified as "special flood hazard areas within the 100-year flood plain with base flood elevations determined" (Reference 7). All of the other sources in this area are located within FEMA Flood Zone X (Reference 7).

The groundwater containment factors for these sources in the shell loading area are unknown, although most have earthen floors and no significant containment (marked with asterisks in the list below). Foundations which have been positively identified during site reconnaissance visits in this area include (Reference 8):

- TNT graining house.
- Ammonia evaporating building.*
- Ammonia finishing building.*
- Shipping houses.*
- TNT and tetryl daily storage bunker.*
- TNT daily storage bunker.*
- Booster test pit.
- Assembly houses.*
- Conveyors.*
- Empty shell storage houses.*
- Paint storage houses.*

A shipping area, approximately 22,441,566 square feet (515.2 acres) in size, is located on DOI property to the north of USN CAX. This area includes several roadways built on old rail beds and tram car lines, one building identified in 1916 engineering drawings as finished ammunition magazine #6, numerous "blast" holes, and a metal drum suspected to be an FM smoke drum which may date from the World War I era (Reference 6). Runoff from this area flows overland into Cheatham Pond, and the shortest overland distance from the sources in this area to Cheatham Pond is approximately 1,000 feet (Reference 1).



LEGEND

UNDERGROUND WATER LINE

PROPERTY BORDER

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ROADWAY - WIDTH VARIES BY ROAD DUTY

STRUCTURE

BUNKER - EXACT DESIGN VARIES

GROUND FEATURE FROM AERIAL PHOTO (LABELED)

TRAM CAR RAILS

UNDERGROUND FUEL TANKS

ABOVE GROUND TANKS

BRIDGE OR TRESTLE

SHEET 13

U.S. DuPONT, or PENNIMAN ENGINEERING SHEET NUMBER

Cyan indicates former Penniman structures.

Black indicates current conditions.

THE SOURCES OF THIS MAP INCLUDE U.S. NAVY, DuPONT, PENNIMAN, COMMONWEALTH OF VIRGINIA, AND OTHER ENGINEERING, SURVEY, AND TOPOGRAPHICAL MAPS. IN ADDITION, U.S. EPA AERIAL PHOTOGRAPHS WERE ELECTRONICALLY DIGITIZED AND OVERLAYED ONTO THIS BASE MAP. SOME OF THIS DATA DATES TO 1916, AND THE DIGITIZATION OF AERIAL PHOTOGRAPHS IS SUBJECT TO MINOR ERRORS AS THE RESULT OF WEATHER AND LIGHTING CONDITIONS. THEREFORE, THE INFORMATION ON THIS MAP SHOULD BE CONSIDERED APPROXIMATE.

1. 1/6/99	RM	Added "Kendall" layer - 1918 panoramic interpretation (12/98)					
2. 1/6/99	RM	Changed title to reflect new information					
3. 1/22/99	RM	Added dirt roads surveyed on 1/12-13/99					
4. 1/27/99	RM	Added 1/99 samples, changed layer colors					
5. 7/16/99	RM	Added file name to border legend					
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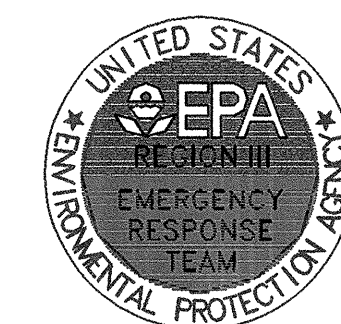
U. S. ENVIRONMENTAL PROTECTION AGENCY - REGION III

PHILADELPHIA PENNSYLVANIA

WESTON FEDERAL PROGRAMS DIVISION

DELTRAN MANAGERS DESIGNERS/CONSULTANTS NEW JERSEY

RPM	Robert Thomson
SATA LEAD	Robert McGlade
PROJ. ENG.	
APPR.	
FILE NAME	SATA000135:/Sites/Cheatham/SATAAUTOCAD/SIMaps/cheatham5.dwg



PENNIMAN SHELL LOADING PLANT

DuPONT'S PENNIMAN "G" PLANT

WILLIAMSBURG VIRGINIA			
DRAWN BY	DATE	DWG. NO.	
ROBERT McGLADE	17 JULY 1998	ONE	
SCALE	PCS. NO.		
AS INDICATED	4381		SHT. 3 OF 3

SCALE IN FEET

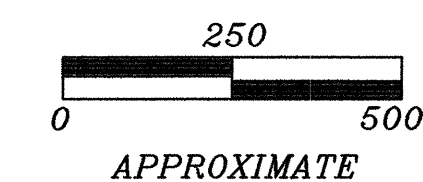


FIGURE 3. FORMER DuPONT "G" PLANT MAP

3.2 Analytical Results

All analytical results for the Penniman Shell Loading Plant Site samples are summarized in Attachment 2. Elevated levels of several organic compounds, one nitroaromatic compound, and many inorganic compounds were found in the waste sources at the site. Table 1 details only those elevated compounds which are regulated by CERCLA and which exceeded EPA Region III Risk-Based Concentrations (RBC) for residential soil in waste samples, using a hazard quotient of 0.1 for non-carcinogens and a cancer risk of 10^{-6} for carcinogens (Reference 13). This report will consider only those contaminants meeting this criteria. It should be noted that many other elevated compounds and analytes were detected in these samples; however, they were either not CERCLA regulated or did not exceed EPA Region III RBCs. Residential soil RBCs were utilized for this report in order to provide a conservative evaluation because the future use of this property is unknown.

All of the waste source samples listed above, with the exception of sample PEN1-SED-06, were soil samples. The background soil (sample PEN1-SO-15) concentrations for the detected compounds are listed in Table 2, along with the RBC levels for these compounds.

Table 2
Soil Sample Background Concentrations and RBC Levels

Compound	Background Concentration (from sample PEN1-SO-15)	EPA Region III RBC for Residential Soil (Reference 13)
2,4,6-trinitrotoluene	< 0.25 mg/kg	21 mg/kg (C)
Antimony	< 0.82 UL mg/kg	3.1286 mg/kg (N)
Arsenic	< 0.87 U mg/kg	0.4258 mg/kg (C)
Cadmium	<0.07 U mg/kg	3.9107 mg/kg (N)
Chromium	2.6 mg/kg	23.46 mg/kg (N)
Lead	11 mg/kg	400 mg/kg* (N)
Manganese	16.08 J mg/kg	156.43 mg/kg (N)

U = Not detected UL = Not detected, quantitation limit is probably higher J = Analyte present, reported value may be inaccurate or imprecise.

* - The RBC level for lead is a screening level only, and should not be considered a substitute for a full, site-specific health risk assessment for this analyte.

NOTE - Analytes evaluated as carcinogens in the EPA Region III RBC Tables are indicated with a "(C)" in the RBC column. Analytes evaluated as non-carcinogens in the EPA Region III RBC Tables are indicated with a "(N)" in the RBC column.

The EPA Region III soil screening level for lead in residential soil is 400 mg/kg. Lead levels in sample numbers PEN1-SO-03 (7,580 mg/kg), PEN1-SO-03A (7,750 mg/kg), PEN1-SO-04 (813 mg/kg), PEN1-SO-06 (1,720 mg/kg), and PEN1-SO-07 (2,070 mg/kg), exceeded this level.

3.3 Conclusions

Numerous contaminants have been identified in the waste source samples exceeding EPA Region III RBCs and elevated levels in accordance with HRS criteria (exceeding three times background levels or exceeding background sample quantitation limits if not detected in background samples). Of these contaminants, 2,4,6-Trinitrotoluene, arsenic, and lead are of particular concern because they are evaluated as carcinogens in the RBC tables (Reference 13).

Arsenic was found to be widespread at levels significantly higher than the RBC (over 77 times higher in sample PEN1-SO-07)) and lead was found to exceed the EPA Region III soil screening level for residential soil in five samples (PEN1-SO-03, PEN1-SO-03A, PEN1-SO-04, PEN1-SO-06, PEN1-SO-07). It should be noted this screening level for lead is utilized as a guideline for considering a site-specific health risk assessment, and cannot be utilized to adequately characterize the threat posed at any specific site.

2,4,6-Trinitrotoluene was found at elevated levels in the TNT graining house sump (samples PEN1-SO-03 and PEN1-SO-03A) and the TNT catch box ruins (sample # PEN1-SO-04). The EPA Region III RBC for 2,4,6-Trinitrotoluene in residential soil is 21 mg/kg, which was exceeded by more than 29 times in the TNT catch box ruins (sample PEN1-SO-04) (Reference 13).

4.0 GROUNDWATER PATHWAY

4.1 Hydrogeologic Setting

The site is located in the Coastal Plain Physiographic province of Virginia consisting of generally unconsolidated, interbedded sands, silts, and clays. Rock formations in this province range in age from the pliocene era to the miocene era, with the majority of formations around the site dating from the miocene era (References 14 and 15).

The primary aquifers found in the site area include, from shallowest to deepest, the Chesapeake Aquifer, the Castle Hayne-Aquia Aquifer, and the Potomac Aquifer. All of these aquifers are separated by clayey or silty confining layers. All of these aquifers may not be useful for potable water in the site area because of salt water intrusion (Reference 15). Table 3 depicts the vertical sequence of the aquifers and confining units in the immediate site area.

4.2 Targets

The primary groundwater targets for this site are the residents within four miles of the site who use groundwater as the sole source of potable water (see Figure 6, 1- and 4-Mile Radii Map). A public water supply is available in the area and is supplied by the Newport News Water Works; however, this water supply is not available to all residences in the site area (Reference 16). Table 4 presents the population within 4-miles of the site which depends upon groundwater for potable water, as well as the total population within specified distance rings (Reference 17).

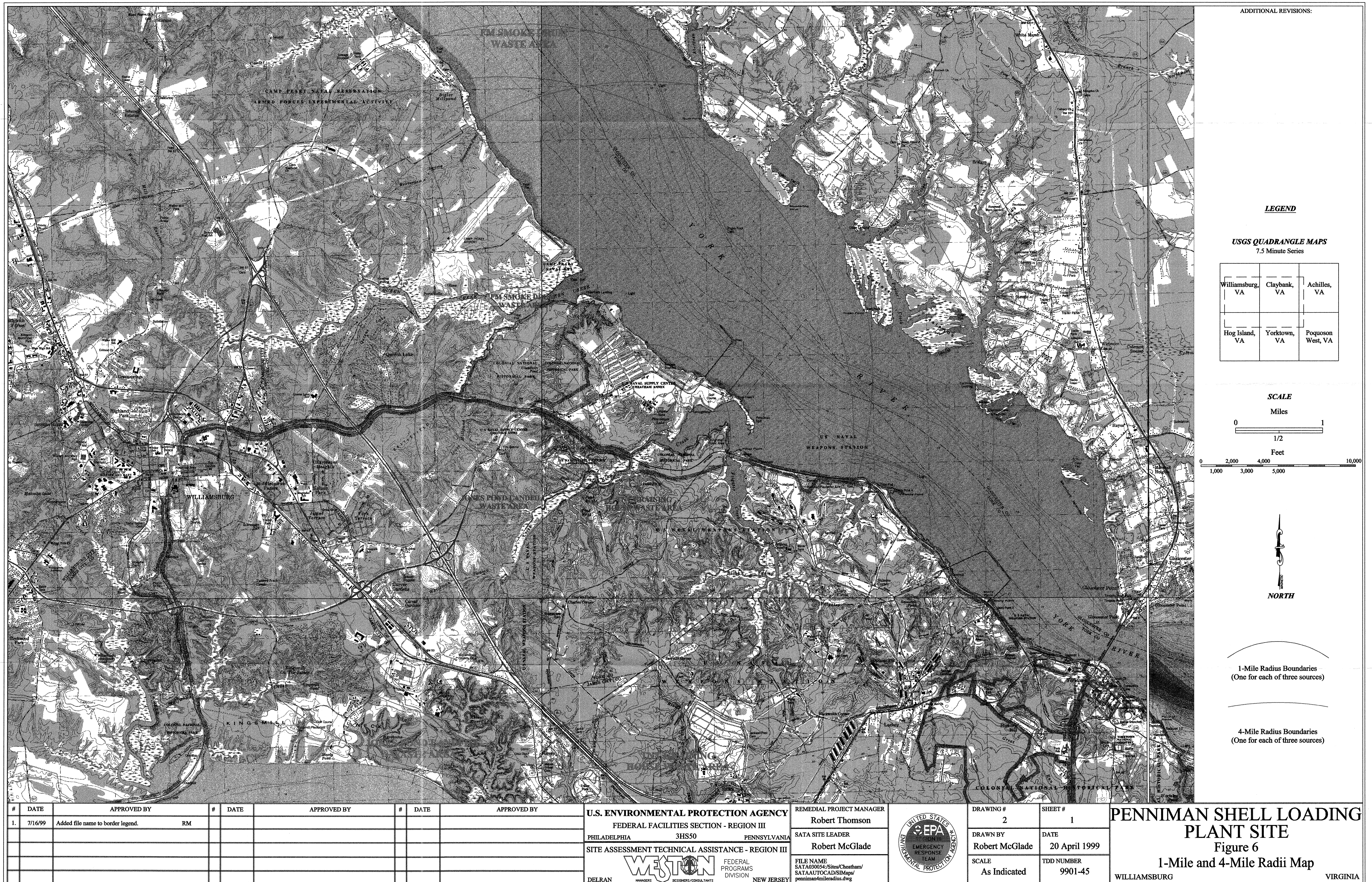


Table 3
Vertical Sequence of Aquifers

System	Series	Specific Unit Name	Principal Lithology	Hydrologic Unit Name	
Tertiary	Pliocene	Yorktown Confining Unit	Clay and Silty Clay	Confining Unit	Northern Atlantic Coastal Plain Aquifer System
		Yorktown-Eastover Aquifer	Sand	Chesapeake Aquifer	
	Miocene	St. Mary's Confining Unit	Silt and Clay	Chesapeake Aquifer	
		St. Mary's-Choptank Aquifer	Sand		
		Calvert Confining Unit	Clay and Sandy Clay	Confining Unit	
	Oligocene	Chickahominy-Piney Point Aquifer	Limestone and Fine to Coarse, Glauconitic Sand	Castle Hayne-Aquia Aquifer	
		Eocene	Nanjemoy-Marlboro Confining Unit		
	Paleocene		Aquia Aquifer		
		Cretaceous		Upper Potomac Confining Unit	Clay and Silty Clay
	Upper Potomac Aquifer			Fine to Medium Sand	Potomac Aquifer
Middle Potomac Confining Unit	Clay and Sandy Clay				
Middle Potomac Aquifer	Fine to Medium Sand				
Lower Potomac Confining Unit	Clay and Sandy Clay				
Lower Potomac Aquifer	Fine to Coarse Sand				
Confining Unit	Clay and Silt			Confining Unit	

Data from Reference 15.

Table 4
Populations Dependent Upon Groundwater

Radius Distance	Population Using Groundwater	Total Population
0-1/4 mile	0	5*
1/4-1/2 mile	0	16
1/2-1 mile	0	64
1-2 miles	128	662
2-3 miles	668	2,367
3-4 miles	1,269	5,282
TOTAL POPULATION	2,065	8,398*

* Number does not reflect 1,843 CAX employees.

NOTE - Distance limit rings originate from a point located centrally between all sources at the site. These population numbers may be slightly larger or smaller depending upon the specific source evaluated.

According to York County representatives, there are no public supply wells located within four miles of the site, and there are no well head protection areas within four miles of the site (Reference 16).

No groundwater samples were collected during this sampling event.

5.0 SURFACE WATER PATHWAY

5.1 Hydrologic Setting

Surface water runoff from the Penniman Shell Loading Plant Site flows either northerly into Cheatham Pond, Jones Pond, and Queen Creek, easterly into Penniman Lake, easterly into the York River, or southerly into King Creek (Reference 1). Both Queen Creek and King Creek flow through wetlands and either through or along a National Park (Reference 1). Jones Pond is a drinking water reservoir for CAX, and Jones Pond, Penniman Lake, and Cheatham Pond are fisheries (Reference 19). Jones Pond and Cheatham Pond discharge directly into Queen Creek, and Penniman Lake discharges directly into King Creek. The wetlands along King and Queen Creeks are tidal in nature, and are considered valuable natural habitats (Reference 18). All of the runoff from the site flows into the York River, a fishery, within one mile downstream and into the Chesapeake Bay, a fishery, within 15 miles downstream.

The elevation of the entire site is 0 to 22 feet above mean sea level (AMSL) (Reference 1).

5.2 Targets

The surface water targets for this site include the 786+ acre Colonial National Park (Reference 2), wetlands frontage which amounts to significantly more than the HRS

maximum scoring limit of 20 miles, King Creek (a fishery), Queen Creek (a fishery), Cheatham Pond (a fishery), Jones Pond (a fishery and drinking water reservoir), Penniman Lake (a fishery), and the Chesapeake Bay (a fishery).

Since the York River and its tributaries are tidal in nature, a 15-mile upstream survey, in addition to the 15-mile downstream investigation, was warranted (see Figure 7, 15-Mile Downstream Survey Map and Figure 8, 15-Mile Upstream Survey Map). The 15-mile downstream investigation and 15-mile upstream investigation identified over 20 miles of wetlands frontage in addition to the targets (with associated downstream or upstream distances) listed in Table 5.

Table 5
Target Distances for Upstream and Downstream 15-mile Limits

Target Name	Distance Encountered	Upstream/Downstream
National Colonial Park	0.00 miles (on site)	---
Ringfield Picnic Area	1.56 miles	Downstream
Catlett Islands	3.92 miles	Downstream
Caraminas Island	6.43 miles	Downstream
Goodwin Island	12.16 miles	Downstream
Chesapeake Bay	12.16 miles	Downstream
Allens Island	13.95 miles	Downstream
Terrapin point	14.83 miles	Upstream

Data from Reference 1.

According to the York County Department of Engineering, Design, and Surveying (Reference 16) and the US EPA Region III Inland Area Contingency Plan CDROM (Reference 20), there is one surface water intake within 15-miles downstream or upstream of the site. This drinking water intake draws water from Jones Pond and serves approximately 1,843 persons on USN CAX (Reference 20). No other drinking water intakes are considered targets. The Jones Pond drinking water intake is located within a ½-mile radius of the site. No other drinking water intakes are located within the four-mile radius of the site.

According to USN CAX personnel, no aquatic endangered or threatened species are present on or around the site (Reference 19).

The nearest wetlands is located on site, and all of the surface water runoff from the site flows directly into wetlands, directly into a fishery, or directly into a drinking water reservoir (Reference 1).



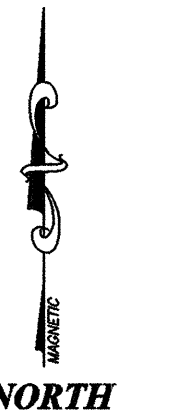
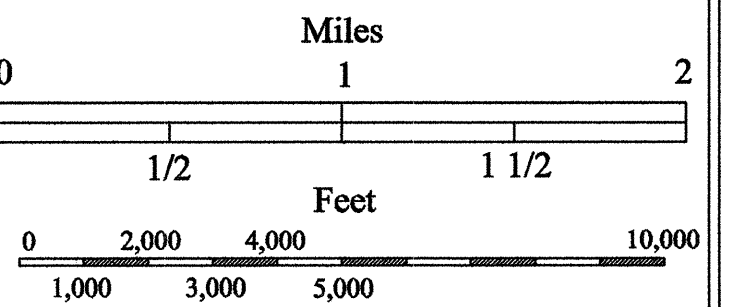
ADDITIONAL REVISIONS:

LEGEND

USGS QUADRANGLE MAPS
7.5 Minute Series

Williamsburg, VA	Claybank, VA	Achilles, VA	New Point Comfort, VA
Hog Island, VA	Yorktown, VA	Poquoson West, VA	Poquoson East, VA

SCALE



Probable Point of Entry Markers
(1 for each route)

5

Downstream Mile Markers
(Cheatham Pond route)

12

Downstream Mile Markers
(King Creek & Penniman Lake route)

6

Downstream Mile Markers
(Queen Creek route)

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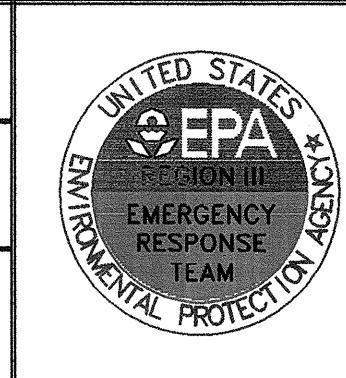
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FEDERAL FACILITIES SECTION - REGION III
PHILADELPHIA 3H550 PENNSYLVANIA

WESTON
FEDERAL PROGRAMS DIVISION
NEW JERSEY

REMEDIAL PROJECT MANAGER
Robert Thomson

SATA SITE LEADER
Robert McGlade

FILE NAME
SATA0305-4/Sites/Cheatham/
SATAAUTOCAD/SIMaps/
penniman4mileradius.dwg



DRAWING #	SHEET #
1	1
DRAWN BY	DATE
Robert McGlade	20 April 1999
SCALE	TDD NUMBER
As Indicated	9901-45

**PENNIMAN SHELL LOADING
PLANT SITE**
Figure 7
15-Mile Downstream Map
WILLIAMSBURG VIRGINIA



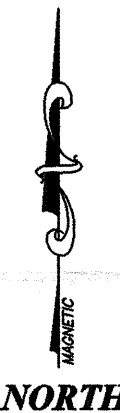
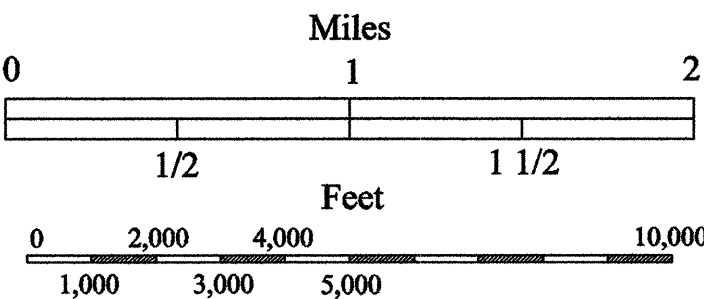
ADDITIONAL REVISIONS:

LEGEND

USGS QUADRANGLE MAPS
7.5 Minute Series

Toano, VA	Gressitt, VA	Gloucester, VA
Norge, VA	Williamsburg, VA	Clay Bank, VA

SCALE



Probable Point of Entry Markers
(1 for each route)

5

Upstream Mile Markers
(Cheatham Pond route)

12

Upstream Mile Markers
(King Creek & Penniman Lake route)

6

Upstream Mile Markers
(Queen Creek route)

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U.S. ENVIRONMENTAL PROTECTION AGENCY
FEDERAL FACILITIES SECTION - REGION III
PHILADELPHIA 3HSS0 PENNSYLVANIA
SITE ASSESSMENT TECHNICAL ASSISTANCE - REGION III

WESTON FEDERAL PROGRAMS DIVISION NEW JERSEY
MANAGERS DESIGNERS/CONSULTANTS

REMEDIAL PROJECT MANAGER
Robert Thomson
SATA SITE LEADER
Robert McGlade
FILE NAME
SATA030054/Sites/Cheatham/
SATAAUTOCAD/SIMaps/
15mileupstreamonly.dwg



DRAWING #	SHEET #
1	1
DRAWN BY	DATE
Robert McGlade	20 April 1999
SCALE	TDD NUMBER
As Indicated	9901-45

**PENNIMAN SHELL LOADING
PLANT SITE**
Figure 8
15-Mile Upstream Map
WILLIAMSBURG VIRGINIA

5.3 Sample Locations

Attachment 1 of this report provides a description of the sample locations, including surface water and sediment samples collected on and off site. Figure 2 graphically depicts these sample locations. The sample locations related to the surface water pathway were as follows:

- One sediment sample was collected from Penniman Lake at the suspected point of discharge of runoff from the ammonia "settling pits" (PEN1-SED-01).
- Two sediment samples were collected from Penniman Lake at the suspected point of discharge of runoff from the TNT catch basin (PEN1-SED-02 and PEN1-SED-02A).
- One sediment sample was collected from the southern portion of the drainage channel leading to Jones Pond and receiving runoff from the landfill area (PEN1-SED-03).
- One sediment sample was collected from the northern portion of the drainage channel leading to Jones Pond and receiving runoff from the landfill area (PEN1-SED-04).
- One sediment sample was collected from Jones Pond (PEN1-SED-05).
- One sediment sample was collected from the drainage ditch leading away from the nitro-starch dry houses (PEN1-SED-07).
- One sediment sample was collected from the wetlands near the discharge of the drainage ditch leading away from the nitro-starch dry houses (PEN1-SED-08).
- One surface water sample was collected from Jones Pond for low concentration analyses (PEN1-DW-01).
- Two surface water samples were collected from Jones Pond for medium concentration analyses (PEN1-SW-01 & PEN1-SW-01A).
- One surface water sample was collected from Penniman Lake (PEN1-SW-02).
- One surface water sample was collected from Cheatham Pond (PEN1-SW-03).

5.4 Analytical Results

Table 6 details the hazardous substances detected in the surface water on and around the site which can be attributed to the site and are considered observed releases. This table details the sample number, compounds, concentrations, attributable waste sources, and background concentrations of these hazardous substances.

Table 6
Observed Release Contaminants in Surface Water

Sample ID	Compound	Analytical Results for Sample	Waste Source Samples/Concentrations	Background Sample/Concentration
PEN1-SW-01	Cadmium	0.35 mg/L	PEN1-SO-03 4 mg/L PEN1-SO-03A 4 mg/L	PEN1-SW-03 0.3 U mg/L
	Chromium	1.5 mg/L	PEN1-SO-07 32.9 mg/L PEN1-SO-11 49.3 mg/L PEN1-SO-12 36.3 mg/L	PEN1-SW-03 0.7 mg/L
	Manganese	105 mg/L	PEN1-SO-03 705 mg/L PEN1-SO-03A 886 mg/L PEN1-SO-06 344 J mg/L PEN1-SO-07 2,070 J mg/L	PEN1-SW-03 8.7 J mg/L
PEN1-SW-01A	Chromium	0.73 mg/L	PEN1-SO-07 32.9 mg/L PEN1-SO-11 49.3 mg/L PEN1-SO-12 36.3 mg/L	PEN1-SW-03 0.7 mg/L
	Manganese	145 mg/L	PEN1-SO-03 705 mg/L PEN1-SO-03A 886 mg/L PEN1-SO-06 344 J mg/L PEN1-SO-07 2,070 J mg/L	PEN1-SW-03 8.7 J mg/L
PEN1-SED-04	Manganese	168 mg/kg	PEN1-SO-03 705 mg/kg PEN1-SO-03A 886 mg/kg PEN1-SO-06 344 J mg/kg PEN1-SO-07 2,070 J mg/kg	PEN1-SED-09 20.8 mg/kg
PEN1-SED-05	Chromium	18.2 mg/kg	PEN1-SO-07 32.9 mg/kg PEN1-SO-11 49.3 mg/kg PEN1-SO-12 36.3 mg/kg	PEN1-SED-09 4.9 mg/kg
PEN1-SED-06	Lead	52.5 mg/kg	PEN1-SO-03 7,580 mg/kg PEN1-SO-03A 400 mg/kg PEN1-SO-04 813 mg/kg PEN1-SO-06 1,720 mg/kg PEN1-SO-07 2,600 mg/kg	PEN1-SED-09 5.1 mg/kg
	Manganese	220 mg/kg	PEN1-SO-03 705 mg/kg PEN1-SO-03A 886 mg/kg PEN1-SO-06 344 J mg/kg PEN1-SO-07 2,070 J mg/kg	PEN1-SED-09 20.8 mg/kg
PEN1-SED-07	Chromium	20.5 mg/kg	PEN1-SO-07 32.9 mg/kg PEN1-SO-11 49.3 mg/kg PEN1-SO-12 36.3 mg/kg	PEN1-SED-09 4.9 mg/kg
	Manganese	101 mg/kg	PEN1-SO-03 705 mg/kg PEN1-SO-03A 886 mg/kg PEN1-SO-06 344 J mg/kg PEN1-SO-07 2,070 J mg/kg	PEN1-SED-09 20.8 mg/kg

U = Not detected. J = Analyte present, reported value may be inaccurate or imprecise.

Four inorganic compounds which are attributable to at least one of the site sources (cadmium, chromium, manganese, and lead) were detected at levels which indicate observed releases to surface water.

Cadmium was found at a concentration of 0.35 mg/L in the surface water sample collected from Jones Pond (sample PEN1-SW-01). Cadmium was not detected in the surface water background sample (sample PEN1-SW-03).

Chromium was found at a concentration of 18.2 mg/kg in the sediment sample collected from Jones Pond, as well as at concentrations of 1.5 mg/l and 0.73 mg/L in the surface water samples collected from Jones Pond (Samples PEN1-SW-01 and PEN1-SW-01A, respectively) at the same location as sample PEN1-SED-05. These levels were considered elevated above the respective background levels in accordance with Hazard Ranking System (HRS) criteria.

Chromium was also found in the drainage ditch leading away from the nitro-starch dry house (sample PEN1-SED-07) at a concentration of 20.5 mg/kg. This level was considered elevated above the background sediment concentration of 4.9 mg/kg (sample PEN1-SED-09) in accordance with HRS criteria.

Lead was found at a concentration of 52.5 mg/kg in the sediment sample collected from the nitro-starch dry house sump (sample PEN1-SED-06). This level was considered elevated above the background sample concentration of 5.1 mg/kg (sample PEN1-SED-09) in accordance with HRS criteria.

Manganese was found at a concentration of 145 mg/L in the surface water sample collected from Jones Pond (sample PEN1-SW-01A). This level was considered elevated above the background sample concentration of 8.7 J mg/L (sample PEN1-SW-03) in accordance with HRS criteria.

Manganese was found in the sediment sample collected from the northern portion of the drainage channel receiving runoff from the Jones Pond landfill (sample PEN1-SED-04) at a concentration 168 mg/kg. This level was considered elevated above the background sample concentration of 20.8 mg/kg (sample PEN1-SED-09) in accordance with HRS criteria.

Manganese was found in the sediment sample collected from the nitro-starch dry house sump (sample PEN1-SED-06) at a concentration of 220 mg/kg. This level was considered elevated above the background sample concentration of 20.8 mg/kg (sample PEN1-SED-09) in accordance with HRS criteria.

Manganese was found in the sediment sample collected from the drainage ditch leading away from the nitro-starch dry house (sample PEN1-SED-07) at a concentration of 101 mg/kg. This level was considered elevated above the background sample concentration of 20.8 mg/kg (sample PEN1-SED-09) in accordance with HRS criteria.

Manganese was found in the drinking water sample collected from Jones Pond (sample PEN1-DW-01) at a concentration of 81.6 $\mu\text{g/L}$. This concentration exceeded the EPA Region III RBC for manganese in drinking water of 73 $\mu\text{g/L}$.

(Reference 13). Manganese is evaluated as a non-carcinogen in the RBC tables, and is evaluated with a hazard quotient of 0.1 in EPA Region III.

5.5 Conclusions

Based upon the analytical results from this sampling event, it appears that the hazardous substances cadmium, chromium, lead, and manganese are impacting targets on and around the site, including wetlands, two fisheries (Jones Pond and Queen Creek), and a surface drinking water intake serving 1,843 people (Jones Pond). The levels at which these contaminants were detected exceed EPA Region III health risk based concentrations in at least one instance (manganese in drinking water, Jones Pond) but do not exceed any regulatory limits.

A source soil sample could not be collected in the Jones Pond area landfill during this sampling event because of the presence of concrete, re-bar, and other debris in the sample location area. A sample of this type should be collected in a future sampling event in order to more accurately identify the potential contaminants impacting Jones Pond.

A drinking water sample was not collected from the USN CAX treatment and pumping station which receives water from and is located near Jones Pond. A sample of this type should be collected in a future sampling event in order to determine the effectiveness of the treatment system and to more accurately determine the threat posed to USN CAX personnel.

Samples PEN1-SW-01, PEN1-SW-01A, and PEN1-DW-01 were collected from the same location in Jones Pond. Sample PEN1-DW-01 was analyzed for low concentration parameters in order to provide a comparison with drinking water standards. Samples PEN1-SW-01 and PEN1-SW-01A were analyzed for medium concentration parameters for comparison with site waste source samples. The analytical results for sample PEN1-DW-01 do not appear to correlate well with the analytical results for sample PEN1-SW-01 and PEN1-SW-01A. This discrepancy should be resolved with future samples collected from these locations with similar analytical parameters.

A suitable drinking water background sample was not collected during this sampling event for comparison with the Jones Pond drinking water sample (PEN1-DW-01). A background drinking water sample should be collected from a similar reservoir utilized for the drinking water supply in the site area in a future sampling event.

Two contaminants, other than those described above, were detected in the drinking water sample collected from Jones Pond (sample PEN1-DW-01) which exceeded their respective EPA Region III RBC for drinking water. These contaminants were the inorganic analyte iron, which was detected at 1,250 $\mu\text{g/L}$ (EPA Region III RBC = 1,095 $\mu\text{g/L}$) and the semi-volatile organic compound 3-nitroaniline, which was detected at 20 $\mu\text{g/L}$ (EPA Region III RBC = 11 $\mu\text{g/L}$). These contaminants were

not addressed in this report because iron is not a CERCLA hazardous substance, and 3-nitroaniline is not attributable to the site based upon the analytical data collected during this sampling event. These contaminants exceeded EPA Region III RBC levels for drinking water in the Jones Pond sample (sample PEN1-DW-01), which is utilized as the sole source of potable water for USN CAX.

6.0 SOIL EXPOSURE AND AIR PATHWAY

6.1 Physical Conditions

The entire site is composed of heavily vegetated woodlands, developed areas, wetlands, or vegetated grassland. There are unimproved roadways which meander through a majority of the site, some of which are gravel covered. There is at least one cabin located on site which is used by hunters and fisherman. Some of the site is secured with fencing; however, this fencing is either decrepit or non-existent in other areas of the site. From within USN CAX, access to the entire site is unrestricted.

The soils throughout the site were primarily sandy, and were relatively loose. These soils would be subject to significant erosion if unvegetated.

6.2 Soil and Air Targets

There are approximately 1,843 full-time workers at USN CAX. In December 1998, a public white-tailed deer hunt was held on both USN CAX and NPS property. (Reference 21). Hunters participating in this hunt had access to all wooded portions of the site. The total number of hunters participating in this hunt is unknown. Boat landings are located on site which provide access to Penniman Lake, Cheatham Pond, and Jones Pond. These boat landings are utilized for fishing and recreational activities (References 9 and 19).

The population within four miles of the site is presented in Table 7.

Table 7
Population Density

Distance Category for Site Sources	Population*
0 miles (within site sources)	0
0 to ¼ miles	5 (not including 1,843 CAX employees)
¼ to ½ miles	16
½ to 1 miles	64
1 to 2 miles	662
2 to 3 miles	2,367
3 to 4 miles	5,282

*Reference 18

NOTE - Distance limit rings originate from a point located centrally between all sources at the site. These population numbers may be slightly larger or smaller depending upon the specific source evaluated.

In addition to the numbers above, there are 1,843 employees working at CAX. These individuals would fall within the 0 to ¼-mile radius circle.

Sensitive environments are located on the site and within a one-mile radius of the site. These sensitive environments include both state and federally listed endangered species (Reference 22), a national historical park, a drinking water intake serving a population of 1,843 persons (Jones Pond), 550 acres of wetlands (see Figures 9 and 10, Wetlands Area Delineation Maps 1 and 2, respectively), and six fisheries (the York River, King Creek, Queen Creek, Penniman Lake, Jones Pond, and Cheatham Pond). There are several federal and state listed endangered or threatened species located in the site area. These species are listed in Table 8.

Table 8.
Federal and State Endangered or Threatened Species

Common Name	Scientific Name (<i>Genus specific-epithet</i>)	Organism Type	Federal or State Listing
Peregrine Falcon	<i>Falco peregrinus</i>	Bird	Federal Endangered
Small Whorled Pogonia	<i>Isotria medeoloides</i>	Plant	Federal Threatened State Endangered
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Bird	Federal Threatened
Sensitive Joint-Vetch	<i>Aeschynomene virginica</i>	Plant	Federal Threatened
Mabee's Salamander	<i>Ambystomatidae mabeei</i>	Amphibian	State Threatened

Data from Reference 20 and United States Fish and Wildlife Service website, <http://www.usfws.gov>.

6.3 Soil Sample Locations

Attachment 1 of this report provides a description of the sample locations, including soil samples collected on and off site. Figure 2 graphically depicts these sample locations.

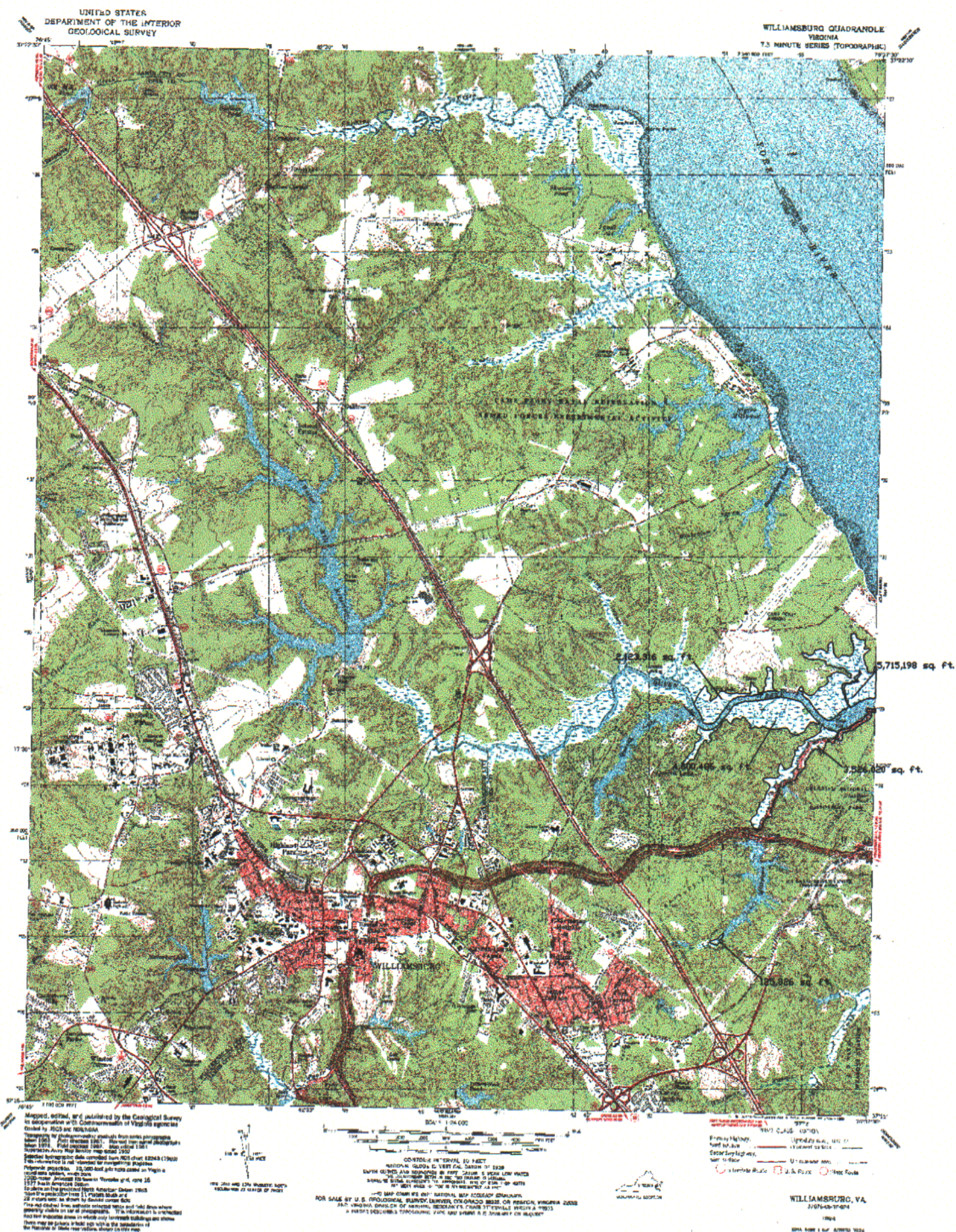
One background soil sample was collected from NPS property away from the site process areas (sample PEN1-SO-15). Six soil samples were collected as waste samples; however, because of their location, they can also be utilized to determine the impact on a target in accordance with HRS guidelines.

Two of the waste source soil samples (samples PEN1-SO-13 and PEN1-SO-14) were soil samples collected from within 200 feet of two occupied office buildings on site, one from 12 to 18 inches deep and one from 18 to 24 inches deep. Both of these samples can be utilized to determine the impact on a target (the workers in the office buildings).

Figure 9. Wetlands Delineation and Area Map #1
Penniman Shell Loading Plant 1-Mile Radius



Figure 10. Wetlands Delineation and Area Map #2
Penniman Shell Loading Plant 1-Mile Radius



Four of the waste source samples (PEN1-SO-09, FM/FS smoke drum-area; PEN1-SO-10, FM/FS smoke drum downgradient; PEN1-SO-11, large blast hole 6-12 inches deep; and PEN1-SO-12, large blast hole 12-18 inches deep) were soil samples collected on DOI National Colonial Historical Park property, and therefore can be utilized to determine the impact on a target (a national park).

Table 1 in Section 3.1 of this report identifies the approximate size of each of the waste sources sampled as soil samples. These approximate sizes can be utilized to determine the surface area of observed soil contamination.

6.4 Soil Analytical Results

Table 9 details the hazardous substances detected in the soil which can be attributed to the site and are considered observed releases. This table details the sample number, compounds, concentrations, attributable waste sources, and background concentrations.

Table 9
Observed Contamination Compounds in Soil

Sample ID	Compound	Concentration	Waste Source Samples/Concentrations	Background Sample/Concentration
PEN1-SO-09	Arsenic	3.5 mg/kg	PEN1-SO-01 6 mg/kg PEN1-SO-03 12.5 mg/kg PEN1-SO-03A 15.5 mg/kg PEN1-SO-04 11 mg/kg PEN1-SO-05 3.5 mg/kg PEN1-SO-06 17.9 mg/kg PEN1-SO-07 33.4 mg/kg PEN1-SO-09 3.5 mg/kg PEN1-SO-10 2.8 mg/kg PEN1-SO-11 11.9 mg/kg PEN1-SO-12 11.8 mg/kg PEN1-SO-13 4.7 m/kg PEN1-SO-14 5.5 mg/kg	PEN1-SO-15 0.87 U mg/kg
PEN1-SO-10	Arsenic	2.8 mg/kg	PEN1-SO-01 6 mg/kg PEN1-SO-03 12.5 mg/kg PEN1-SO-03A 15.5 mg/kg PEN1-SO-04 11 mg/kg PEN1-SO-05 3.5 mg/kg PEN1-SO-06 17.9 mg/kg PEN1-SO-07 33.4 mg/kg PEN1-SO-09 3.5 mg/kg PEN1-SO-10 2.8 mg/kg PEN1-SO-11 11.9 mg/kg PEN1-SO-12 11.8 mg/kg PEN1-SO-13 4.7 m/kg PEN1-SO-14 5.5 mg/kg	PEN1-SO-15 0.87 U mg/kg

Table 9
Observed Contamination Compounds in Soil

Sample ID	Compound	Concentration	Waste Source Samples/Concentrations	Background Sample/Concentration
PEN1-SO-11	Arsenic	11.9 mg/kg	PEN1-SO-01 6 mg/kg PEN1-SO-03 12.5 mg/kg PEN1-SO-03A 15.5 mg/kg PEN1-SO-04 11 mg/kg PEN1-SO-05 3.5 mg/kg PEN1-SO-06 17.9 mg/kg PEN1-SO-07 33.4 mg/kg PEN1-SO-09 3.5 mg/kg PEN1-SO-10 2.8 mg/kg PEN1-SO-11 11.9 mg/kg PEN1-SO-12 11.8 mg/kg PEN1-SO-13 4.7 m/kg PEN1-SO-14 5.5 mg/kg	PEN1-SO-15 0.87 U mg/kg
	Chromium	49.3 mg/kg	PEN1-SO-11 49.3 mg/kg PEN1-SO-12 36.3 mg/kg	PEN1-SO-15 2.6 mg/kg
PEN1-SO-12	Arsenic	11.8 mg/kg	PEN1-SO-01 6 mg/kg PEN1-SO-03 12.5 mg/kg PEN1-SO-03A 15.5 mg/kg PEN1-SO-04 11 mg/kg PEN1-SO-05 3.5 mg/kg PEN1-SO-06 17.9 mg/kg PEN1-SO-07 33.4 mg/kg PEN1-SO-09 3.5 mg/kg PEN1-SO-10 2.8 mg/kg PEN1-SO-11 11.9 mg/kg PEN1-SO-12 11.8 mg/kg PEN1-SO-13 4.7 m/kg PEN1-SO-14 5.5 mg/kg	PEN1-SO-15 0.87 U mg/kg
	Chromium	36.3 mg/kg	PEN1-SO-07 32.9 mg/kg PEN1-SO-11 49.3 mg/kg	PEN1-SO-15 2.6 mg/kg
PEN1-SO-13	Arsenic	4.7 mg/kg	PEN1-SO-01 6 mg/kg PEN1-SO-03 12.5 mg/kg PEN1-SO-03A 15.5 mg/kg PEN1-SO-04 11 mg/kg PEN1-SO-05 3.5 mg/kg PEN1-SO-06 17.9 mg/kg PEN1-SO-07 33.4 mg/kg PEN1-SO-09 3.5 mg/kg PEN1-SO-10 2.8 mg/kg PEN1-SO-11 11.9 mg/kg PEN1-SO-12 11.8 mg/kg PEN1-SO-13 4.7 m/kg PEN1-SO-14 5.5 mg/kg	PEN1-SO-15 0.87 U mg/kg

Table 9
Observed Contamination Compounds in Soil

Sample ID	Compound	Concentration	Waste Source Samples/Concentrations	Background Sample/Concentration
PEN1-SO-14	Arsenic	5.5 mg/kg	PEN1-SO-01 6 mg/kg PEN1-SO-03 12.5 mg/kg PEN1-SO-03A 15.5 mg/kg PEN1-SO-04 11 mg/kg PEN1-SO-05 3.5 mg/kg PEN1-SO-06 17.9 mg/kg PEN1-SO-07 33.4 mg/kg PEN1-SO-09 3.5 mg/kg PEN1-SO-10 2.8 mg/kg PEN1-SO-11 11.9 mg/kg PEN1-SO-12 11.8 mg/kg PEN1-SO-13 4.7 m/kg PEN1-SO-14 5.5 mg/kg	PEN1-SO-15 0.87 U mg/kg

Arsenic was found in the soil within 200 feet of two currently occupied office buildings on site. Arsenic was found at a concentration of 4.7 mg/kg at a depth of 18-24 inches (sample PEN1-SO-13) and at a concentration of 5.5 mg/kg at a depth of 18-24 inches (sample PEN1-SO-14). Arsenic was not detected in the background soil sample (sample PEN1-SO-15). The EPA Region III RBC for arsenic in residential soil is 0.42582 mg/kg. Arsenic is considered a carcinogen on the RBC tables and is evaluated at a cancer risk of 10^{-6} in EPA Region III. The surface area of the observed contamination was determined based upon a panoramic photograph of the Penniman Shell Loading Plant taken in 1918 (Reference 23). This photo clearly depicts a drum storage area.

6.5 Air Monitoring

During the sampling event, a Photovac *Microtip* and Ludlum *MicroR* meter were used to monitor air quality. These instruments recorded no levels that exceeded background parameters.

6.6 Conclusions

The arsenic levels detected in the soil within 200 feet of the occupied office buildings exceeded three times background levels and exceeded the EPA Region III RBC screening level for arsenic in residential soil by almost thirteen times. The workers occupying these buildings during working hours are considered targets under the HRS guidelines.

Arsenic and chromium soil contamination have been confirmed at levels exceeding three times background and exceeding EPA Region III RBC's for residential soil on NPS property in areas accessible to and frequented by hunters and fisherman (blast

holes, samples PEN1-SO-11 and PEN1-SO-12). There are no persons residing within 200 feet of these areas.

The observed soil contamination at this site has been confirmed to be impacting a target, the National Colonial Park. Other sensitive environments, including wetlands and threatened and endangered species, may be impacted by this soil contamination.

7.0 SUMMARY

The Penniman Shell Loading Plant sampling event conducted during the week of 11 January 1999 gathered a majority of the necessary data to assess the threat posed to human health and the environment, and to evaluate the site as a candidate for the National Priorities List using the HRS. Several waste samples were collected and analyzed to characterize the types and concentrations of hazardous substances deposited at the site, and surface water and sediment samples were collected from the on-site lakes and ponds to determine the impact on several targets. Other information was collected to confirm target populations and environments potentially at risk from the site.

Based upon the large size of the site, the large number of potential sources, and the direction of RPM Thomson, the January 1999 sampling event was geared towards the characterization of waste sources, contaminants, and the threat posed to the drinking water intake at Jones Pond as well as the nearby sensitive environments, including National Colonial Park and threatened or endangered species. Groundwater samples were not collected during this sampling event, nor were off-site samples collected from nearby wetlands or creeks and rivers to document if hazardous substances have migrated off site. A PREscore evaluation was not tasked and was not performed.

This sampling event indicated that six inorganic compounds and one nitroaromatic compound were present at elevated concentrations which exceeded EPA Region III RBCs in waste sources on site. Four of these compounds (cadmium, chromium, lead, and manganese) were detected in sediment and surface water samples at levels which indicate an observed release in the surface water pathway and two of these compounds (arsenic and chromium) were detected within two feet of the surface at levels which indicate observed contamination in the soil/air pathway at the site. All of these compounds were found at levels which exceeded health risk-based screening levels and none of them were found at levels which exceeded regulatory limits.

Based upon the analytical results from this sampling event, the ammonia evaporating area and the TNT graining house area could be considered health threats based upon their accessibility and their arsenic levels when evaluated as residential soil areas under the EPA Region III RBCs. In addition, these areas could be considered potential threats to Penniman Lake, a fishery and recreational area based upon elevated arsenic levels. It should be noted, however, that there is no analytical data which indicates that these areas are currently impacting Penniman Lake. In addition, neither of these areas are located within 200 feet of any residences or workplaces.

Based upon the analytical results from the storm drain mixer and the underground mixing tank sampled in the 75-m process line area of the former "G" plant, any underground tanks or pipes in this area could be considered sources of arsenic, lead, and manganese contamination. To date, these structures have been identified as subsurface steel in relatively poor condition. The most likely impact these sources have would be on the local groundwater. Since no groundwater samples were collected in January 1999, the threat posed by these sources cannot be fully evaluated in this report. Future actions at this site should include an investigation of the groundwater in the area to determine the potential threat posed by these, and other, sources at the site. This investigation should include the installation of monitoring wells in the 75mm process line area of the former "G" plant.

The slag material found throughout the site, both on CAX and NPS property, is contaminated with antimony, arsenic, chromium, lead, and manganese. Of these, arsenic and lead are of particular concern. The lead level in the sample collected from this slag material exceeds the EPA Region III soil screening level for lead in residential soil (400 mg/kg), and the arsenic level exceeds the EPA Region III RBC for arsenic in residential soil (0.4258 mg/kg). These levels may pose a significant threat to persons exposed to this slag material, and may contribute to the migration of contaminants off-site, since this slag material is wide spread and uncontained. It should be noted that the majority of this slag material consists of intact, relatively hard rock-like material. The potential for this material to migrate as particulates is relatively low; however, it may be possible that contaminants are leaching from this slag material and impacting large areas of the site. SATA recommends that this material be investigated further, to include a TCLP sample for metals, as well as a soil sample from the overland flow path of surface water runoff from a portion of this slag material. This type of sampling would be useful in order to fully evaluate the potential threat posed by this material.

Based upon the analytical results from the soil sample collected under and around the FM/FS smoke drum in the magazine area on NPS property, the soil in the magazine area could be considered a health threat based upon its accessibility and the level of arsenic present when evaluated as a residential soil area under the EPA Region III RBCs. It should be noted that the RBC screening levels are based upon soil ingestion, and are primarily geared towards small children. The residential RBC values have been utilized in this report in order to provide a conservative evaluation of the site and because the future use of this property is unknown. Applying this level to the magazine area may not be appropriate. SATA recommends that a site specific health risk assessment be conducted to evaluate the threat posed to individuals using this area for recreation by these elevated arsenic levels.

Based upon the analytical results from the soil samples collected in one of the large blast holes in the magazine area on NPS property, the soil in these blast holes could be considered health threats based upon their accessibility and the levels of arsenic and chromium present when evaluated as residential soil areas under the EPA Region III RBC's. As stated above, the RBC screening levels are based upon soil ingestion, and are primarily geared towards small children. Applying this level to the blast holes may not be appropriate. SATA recommends that a site specific health risk assessment be conducted to evaluate the threat posed to individuals using the magazine area for recreation by these elevated arsenic and chromium levels.

The 1918 drum storage area is contaminated with arsenic at levels exceeding EPA Region III RBCs for residential soil. This contamination was confirmed between the depths of 12 and 24 inches, within 200 feet of buildings currently occupied by workers. Because the arsenic levels exceed the EPA Region III RBCs for residential soil, the contamination is within two feet of the surface, and the contamination is within 200 feet of occupied places of work (the two buildings), SATA recommends that this area be evaluated under a site specific health risk assessment in order to determine the threat posed to these workers.

The nitro-starch dry houses appear to pose a potential threat to Queen Creek and to the wetlands area to the north. Analytical results indicate that lead and manganese are present at elevated levels exceeding the EPA Region III RBC for residential soil in the nitro-starch dry house sumps, and that manganese is present in the drainage ditch leading away from these dry houses and into Queen Creek and the wetlands area.

Contaminants from the site appear to be impacting Jones Pond, which is the drinking water supply for USN CAX. Since this pond serves as a drinking water supply for CAX, is used for recreational purposes, is a fishery, and drains into Queen Creek and subsequently the York River, SATA recommends that a more specific investigation be conducted of the Jones Pond landfill area, which appears to be the source of contamination. All of the runoff from this landfill area flows into Jones Pond, and this landfill is entirely exposed to weather and the elements with no engineering controls to prevent erosion or runoff from entering Jones Pond. Based upon the currently available information, the January 1999 site sampling event and periodic site reconnaissance visits, it is SATA's opinion that this area currently poses the most significant threat to human health and the environment at this site. This area should be addressed in a timely manner.

8.0 REFERENCES

1. U. S. Department of the Interior, Geological Survey. 1978. *Clay Bank, Virginia Topographical Map*. DMA 5658 I SE-series V834 37076-C5-TF-024.
2. U.S. Department of the Navy, Bureau of Yards & Docks, Atlantic Division. 1989. *Real Estate Summary Map, Y&D Drawing No. 980058, LANTDOCKS Drawing No. 65058, Code ID No. 80091*.
3. P. Christopher Goodwin & Associates, Inc. 1996. *Phase I Architectural and Archaeological Survey at Cheatham Annex, Volume I*. September.
4. Environmental Photographic Interpretation Center. 1997. Fort John Custis/Cape Charles Air Force Station Site Aerial Photograph.
5. McGlade, R. 1997. WESTON SATA Personal Log book #SATA03A01101. Delran, NJ. 8-9 December.

6. Kendall, J. R. 1998. *Trip Report for the Cheatham Annex Site Visit Conducted on 15 September 1998*. CBW Expert. Roy F. Weston, Inc., Edgewood, MD. 22 September.
7. Federal Emergency Management Agency. 1988. National Flood Insurance Program Flood Insurance Rate Map, York County, Virginia. Incorporated Areas Panel 30 of 45. Community Panel Number 5101820030B.
8. E.I. DuPont de Nemours, Inc. 1916. Engineering Drawings for the Construction of the Penniman Plant.
9. Schirmer, R. 1999. US Navy LANTDIV. Telephone conversation with SATA member Robert McGlade. Norfolk, VA. 1999.
10. Ellis, J. *Eye Deep in Hell, Trench Warfare in WWI*. n.d., n.p.
11. *American Guns in the War*. n.d., n.p., pp. 108 to 138.
12. Harris, D. 1998. VA DES. Conversation with SATA member Robert McGlade during site reconnaissance meeting. February.
13. U.S. Environmental Protection Agency. 1999. *EPA Region III Risk-Based Concentration Table*. Philadelphia, PA. April.
14. Commonwealth of Virginia, Division of Mineral Resources. 1993. *Geology Map of Virginia*. Williams & Heintz Map Corporation, Capitol Heights, MD.
15. U.S. DOI Geological Survey. 1997. Groundwater Atlas of the United States. Reston, VA.
16. Swilley, M. 1999. Engineer II, York County Department of EDS. Telephone conversation with SATA member Robert McGlade. Delran, NJ. 4 March.
17. Frost & Associates, Inc. 1999. CENTRACTS Report. 9 April.
18. U.S. Fish and Wildlife Service. National Wetlands Inventory Maps.
19. Hogg, Butch. 1999. Chief Environmental Resources Officer, USN CAX, Conversation with SATA member Robert McGlade. January.
20. U.S. EPA Region III. 1997. Inland Area Contingency Plan, Virginia, CDROM. Philadelphia, PA.
21. Burnett, J. Chief Ranger, USDOJ NPS. Telephone conversation with

SATA member Mrinal Biswas. Delran, NJ. December.

22. U.S. Fish and Wildlife Service. 1994. 50 C.F.R 17.11.
23. Hagley Museum and Library. 1918 Panoramic Photograph PO 98-115
Negative Number 69.161.3.7. Wilmington, DE.

Attachments: 1 - Sample Summary Log
2 - Analytical Summary Tables
3 - Photograph Log
4 - Chronology of Events (January 1999 Sampling Event)

ATTACHMENT 1
SAMPLE SUMMARY LOG

Sample Summary Log

Sample Number	Sample Type	Location and Objective	Date Collected	Time Collected
PEN1-DW-01	Surface Drinking Water	A surface sample collected from Jones Pond at the same location as sample PEN1-SW-01. This sample was analyzed as drinking water and was utilized to determine the impact on a target (Jones Pond, which is a drinking water source for Cheatham Annex).	12 January 1999	1555
PEN1-SED-01	Sediment	A sediment sample collected from Penniman Lake at the suspected point of discharge from the ammonia "settling pits." This sample was utilized to determine an observed release, establish attribution, and determine the impact on a target (Penniman Lake, a fishery).	12 January 1999	1325
PEN1-SED-02	Sediment	A sediment sample collected from Penniman Lake at the suspected point of discharge from the TNT catch basin. This sample was utilized to determine an observed release, establish attribution, and determine the impact on a target (Penniman Lake, a fishery).	12 January 1999	0950
PEN1-SED-02A	Sediment	A duplicate sample of PEN1-SED-2.	12 January 1999	1000
PEN1-SED-03	Sediment	A sediment sample collected from the southern portion of the drainage channel receiving runoff from the landfill area near Jones Pond. This sample was utilized to characterize the types and concentrations of hazardous substances present on site.	13 January 1999	1320
PEN1-SED-04	Sediment	A sediment sample collected from the northern portion of the drainage channel receiving runoff from the landfill area near Jones Pond. This sample was utilized to characterize the types and concentrations of hazardous substances present on site.	13 January 1999	1240
PEN1-SED-05	Sediment	A sediment sample collected from Jones Pond. This sample was utilized to determine the impact on a target (Jones Pond, which is a fishery and also is the drinking water supply for Cheatham Annex).	12 January 1999	1640
PEN1-SED-06	Waste Source	A solid waste sample collected from a sump in one of the nitro-starch dry houses. This sample was used to characterize the types and concentrations of hazardous substances present on site.	13 January 1999	0845

Sample Summary Log

Sample Number	Sample Type	Location and Objective	Date Collected	Time Collected
PEN1-SED-07	Sediment	A sediment sample collected from the drainage ditch leading away from the nitro-starch dry house (suspected to have received discharge from the sump where sample PEN1-SED-6 is collected) and into the wetlands area. This sample was used to establish attribution and determine the impact on a target (the wetlands).	13 January 1999	0820
PEN1-SED-08	Sediment	A sediment sample collected near the point of discharge of the drainage ditch where sample PEN1-SED-7 was collected. This sample was used to determine the impact on a target (the wetlands).	13 January 1999	0805
PEN1-SED-09	Sediment	A sediment sample collected from the same location as sample PEN1-SW-03 in Cheatham Pond. This sample was used as a background sediment sample.	13 January 1999	1015
PEN1-SO-01	Waste Source	A solid waste sample collected from the "settling pits" immediately north of the ammonia finishing building foundation. This sample was utilized to characterize the types and concentrations of hazardous substances present on site.	12 January 1999	1350
PEN1-SO-02	Not collected	This sample was not collected.	NA	NA
PEN1-SO-03	Waste Source	A solid waste sample collected from within the sump, inside the ruins of the TNT graining house to characterize the types and concentrations of hazardous substances present on site.	12 January 1999	0855
PEN1-SO-03A	Waste Source	A duplicate sample of PEN1-SO-03.	12 January 1999	0855
PEN1-SO-04	Waste Source	A solid waste sample collected from within the TNT catch box ruins to characterize the types and concentrations of hazardous substances present on site.	12 January 1999	0925
PEN1-SO-05	Waste Source	A solid waste sample collected from inside the "storm drain mixer" located between the TNT graining house and the ammonia evaporating ruins to the east of the 75-mm shell loading plant. This sample was utilized to characterize the types and concentrations of hazardous substances present on site.	12 January 1999	1410

Sample Summary Log

Sample Number	Sample Type	Location and Objective	Date Collected	Time Collected
PEN1-SO-06	Waste Source	A solid waste sample collected from inside the "mixing tank" located to the north of the paint store buildings near the 75-mm shell loading plant to characterize the types and concentrations of hazardous substances present on site.	12 January 1999	1050
PEN1-SO-07	Waste Source	A solid waste sample collected from the slag material located near sample PEN1-SO-06 to characterize the types and concentrations of hazardous substances present on site.	12 January 1999	1100
PEN1-SO-08	Not Collected	This sample was not collected.	NA	NA
PEN1-SO-09	Waste Source	A solid waste sample collected from beneath the suspected FM/FS smoke drum in the magazine area at a depth of 6 to 12 inches. This sample was utilized to characterize the types and concentrations of hazardous substances present on site.	13 January 1999	0920
PEN1-SO-10	Waste Source	A soil/solid waste grab sample collected from the dead vegetation area down gradient of the suspected FM/FS smoke drum located in the magazine area. This sample was collected at a depth of 6 to 12 inches and was used to characterize the types and concentrations of hazardous substances present on site.	13 January 1999	0935
PEN1-SO-11	Waste Source	A solid waste grab sample collected from a depth of 6 to 12 inches in the bottom of one of the large blast holes in the magazine area. This sample was used to characterize the types and concentrations of hazardous substances present on site.	13 January 1999	0830
PEN1-SO-12	Waste Source	A solid waste grab sample collected from a depth of 12 to 18 inches in the bottom of one of the large blast holes in the magazine area. This sample will be collected from the same hole as sample PEN1-SO-11 and was used to characterize the types and concentrations of hazardous substances present on site.	13 January 1999	0845
PEN1-SO-13	Waste Source	A solid waste sample collected from a depth of 12 to 18 inches in the area depicted in the 1918 panoramic photographs as a waste drum storage area. This sample was collected from within 200 feet of occupied office buildings, and was used to characterize the types and concentrations of hazardous substances present on site as well as determine the impact on a target, the workers in the office buildings.	13 January 1999	1415

Sample Summary Log

Sample Number	Sample Type	Location and Objective	Date Collected	Time Collected
PEN1-SO-14	Waste Source	A solid waste sample collected from a depth of 18 to 24 inches in the area depicted in the 1918 panoramic photographs as a waste drum storage area. This sample was collected from the same hole as sample PEN1-SO-13, and was used to characterize the types and concentrations of hazardous substances present on site.	13 January 1999	1430
PEN1-SO-15	Soil	A solid sample collected from DOI property to the north and upgradient of the former magazine area. This sample was used as a background soil sample.	13 January 1999	1245
PEN1-SW-01	Surface Water	A surface water sample collected from Jones Pond at the same location as PEN1-SED-5. This sample was utilized to determine the impact on a target (Jones Pond, which is a fishery and also the drinking water supply for Cheatham Annex).	12 January 1999	1555
PEN1-SW-01A	Surface Water	A duplicate of surface water sample PEN1-SW-1.	12 January 1999	1555
PEN1-SW-02	Surface Water	A surface water sample collected from Penniman Lake at the same location as PEN1-SED-2. This sample was utilized to determine the impact on a target (Penniman Lake, which is a fishery).	12 January 1999	0950
PEN1-SW-03	Surface Water	A surface water sample collected from Cheatham Pond. This sample was used as a background surface water sample.	13 January 1999	0930
PEN1-FB	Field Blank	An aqueous field blank sample collected in the field during the sampling event to determine proper field sampling procedures.	12 January 1999	1215
PEN1-FBLC	Field Blank - Low Concentration	An aqueous field blank sample collected in the field during the sampling event to determine proper field sampling procedures and analyzed for low concentration contaminants.	12 January 1999	1600
PEN1-RB	Rinsate Blank	An aqueous rinsate blank sample collected from the reusable sampling equipment for solid matrices to determine the effectiveness of field decontamination procedures.	13 January 1999	0915
PEN1-TB	Trip Blank	An aqueous trip blank sample collected prior to departure to determine proper sample handling procedures.	11 January 1999	0800
PEN1-TBLC	Trip Blank - Low Concentration	An aqueous trip blank sample collected prior to departure to determine proper sample handling procedures and analyzed for low concentration contaminants.	12 January 1999	1200

ATTACHMENT 2
ANALYTICAL SUMMARY TABLES

Analytical Summary Tables
Glossary of Data Qualifier Codes

ORGANIC DATA

Codes Related to Identification

(NO CODE) = Confirmed identification.

U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

B = Not detected substantially above the level reported in laboratory or field blanks

R = Unusable result. Analyte may or may not be present in the sample. Supporting data necessary to confirm result.

N = Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling efforts.

Codes Related to Quantitation

J = Analyte present. Reported value may or may not be accurate or precise.

K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.

L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

UJ = Not detected, quantitation limit may be inaccurate or imprecise.

UL = Not detected, quantitation limit is probably higher.

Other Codes

NJ = Qualitative identification questionable due to poor resolution. Presumptively present at approximate quantity.

Q = No analytical result.

Analytical Summary Tables
Glossary of Data Qualifier Codes (continued)

INORGANIC DATA

Codes Related to Identification

(NO CODE) = Confirmed identification.

U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

B = Not detected substantially above the level reported in laboratory or field blanks

R = Unusable result. Analyte may or may not be present in the sample. Supporting data necessary to confirm result.

Codes Related to Quantitation

J = Analyte present. Reported value may or may not be accurate or precise.

K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.

L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

[] = Analyte present. As values approach the IDL the quantitation may not be accurate.

UJ = Not detected, quantitation limit may be inaccurate or imprecise.

UL = Not detected, quantitation limit is probably higher.

Other Codes

Q = No analytical result.

**Background Samples - U.S. EPA CLP
Inorganic Analysis Data Sheet**

Site Name: Penniman Shell Loading Plant

All units in mg/kg (solid) or ug/L (liquid)

CAS#	Compound	Soil Sample ID:		Surface Water Sample ID:		Sediment Sample ID:	
		PEN1-SO-15		PEN1-SW-03		PEN1-SED-09	
		Results	Q	Results	Q	Results	Q
7429905	Aluminum	2050	-	97.7	-	2920	-
7440360	Antimony	0.82	UL	3.5	UL	1.1	B
7440382	Arsenic	0.87	U	5.1	U	4.2	-
7440393	Barium	12.4	-	14	-	19.8	-
7440417	Beryllium	0.07	U	0.3	U	0.2	-
7440439	Cadmium	0.07	U	0.3	U	0.7	U
7440702	Calcium	360	J	46800	J	1270	J
7440473	Chromium	2.6	-	0.7	-	4.9	-
7440484	Cobalt	0.44	-	1.6	-	0.98	-
7440508	Copper	14.74	J	21.8	J	8.5	-
7439896	Iron	2370	-	124	-	3470	-
7439921	Lead	11	-	15.7	-	5.1	-
7439954	Magnesium	154	-	3040	-	295	J
7439965	Manganese	16.08	J	8.7	J	20.8	-
7439976	Mercury	0.06	U	0.1	U	0.06	U
7440020	Nickel	1.3	-	3.1	-	2.3	-
7440097	Potassium	194	-	24200	-	233	-
7782492	Selenium	0.73	U	3.1	U	0.75	U
7440224	Silver	0.23	-	0.7	-	0.17	U
7440235	Sodium	39	L	20300	L	69.6	-
7440280	Thallium	1.1	U	4.9	U	1.2	UL
7440622	Vanadium	6.5	-	1.4	-	7.2	-
7440666	Zinc	17.42	J	34.8	J	9.8	-
74908	Cyanide	0.04	U	0.6	U	0.04	UL

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive

9285.7-14FS, "Using Qualified Data to Document an Observed Release -

Quick Reference Fact Sheet" July 1994. These adjusted results were utilized for comparison with site samples.

**Background Samples - U.S. EPA CLP
Pesticide/Polychlorinated Biphenyl Analysis Data Sheet**

Site Name: Penniman Shell Loading Plant

All units in mg/kg (solid) or ug/L (liquid)

CAS#	Compound	Soil Sample ID:		Surface Water Sample ID:		Sediment Sample ID:	
		PEN1-SO-15		PEN1-SW-03		PEN1-SED-09	
		Results	Q	Results	Q	Results	Q
319846	alpha-HCH	2	U	0.05	U	0.002	U
319857	beta-HCH	2	U	0.05	U	0.002	U
319868	delta-HCH	2	U	0.05	U	0.002	U
58899	gamma-HCH (Lindane)	2	U	0.05	U	0.002	U
76448	Heptachlor	2	U	0.008	B	0.002	U
309002	Aldrin	2	U	0.05	U	0.002	U
1024573	Heptachlor epoxide	2	U	0.05	U	0.002	U
959988	Endosulfan I	2	U	0.05	U	0.002	U
60571	Dieldrin	5.518	J	0.1	U	0.004	U
72559	4,4'-DDE	5	J	0.1	U	0.00011	J
72208	Endrin	9.35	J	0.1	U	0.004	U
33213659	Endosulfan II	3.9	U	0.1	U	0.004	U
72548	4,4'-DDD	7.7	J	0.1	U	0.00023	J
1031078	Endosulfan sulfate	8.3	J	0.1	U	0.004	U
50293	4,4'-DDT	3.9	U	0.008	J	0.004	U
72435	Methoxychlor	2.1	B	0.5	U	0.02	U
53494705	Endrin ketone	3.9	U	0.1	U	0.0011	U
7421363	Endrin aldehyde	3.9	U	0.1	U	0.004	U
5103719	alpha-Chlordane	2	U	0.05	U	0.00035	J
5103742	gamma-Chlordane	2	U	0.05	U	0.002	U
8001352	Toxaphene	200	U	5	U	0.2	U
12674112	Aroclor-1016	39	U	1	U	0.04	U
11104282	Aroclor-1221	80	U	2	U	0.081	U
11141165	Aroclor-1232	39	U	1	U	0.04	U
53469219	Aroclor-1242	39	U	1	U	0.04	U
12672296	Aroclor-1248	39	U	1	U	0.04	U
11097691	Aroclor-1254	39	U	1	U	0.04	U
11096825	Aroclor-1260	39	U	1	U	0.04	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive

9285.7-14FS, "Using Qualified Data to Document an Observed Release -

Quick Reference Fact Sheet" July 1994. These adjusted results were utilized for comparison with site samples.

**Background Samples - U.S. EPA CLP
Volatile Organic Analysis Data Sheet**

Site Name: <u>Penniman Shell Loading Plant</u>		Soil Sample ID:		Surface Water Sample ID:		Sediment Sample ID:	
All units in mg/kg (solid) or ug/L (liquid)		PEN1-SO-15		PEN1-SW-03		PEN1-SED-09	
CAS#	Compound	Results	Q	Results	Q	Results	Q
74873	Chloromethane	12	U	10	U	0.012	U
74839	Bromomethane	12	U	10	U	0.012	U
75014	Vinyl chloride	12	U	10	U	0.012	U
75003	Chloroethane	12	U	10	U	0.012	U
75092	Methylene chloride	4	B	2	B	0.003	B
67641	Acetone	69	B	10	U	0.025	B
75150	Carbon disulfide	12	U	10	U	0.012	U
75354	1,1-Dichloroethene	12	U	10	U	0.012	U
75343	1,1-Dichloroethane	12	U	10	U	0.012	U
540590	1,2-Dichloroethene (total)	12	U	10	U	0.012	U
67663	Chloroform	12	U	10	U	0.012	U
107062	1,2-Dichloroethane	12	U	10	U	0.012	U
78933	2-Butanone (MEK)	12	UJ	10	U	0.012	UJ
71556	1,1,1-Trichloroethane	12	U	10	U	0.012	U
56235	Carbon tetrachloride	12	U	10	U	0.012	U
75274	Bromodichloromethane	12	U	10	U	0.012	U
78875	1,2-Dichloropropane	12	U	10	U	0.012	U
542756	1,3-Dichloropropene	12	U	10	U	0.012	U
79016	Trichloroethene	12	U	10	U	0.012	U
124481	Dibromochloromethane	12	U	10	U	0.012	U
79005	1,1,2-Trichloroethane	12	U	10	U	0.012	U
71432	Benzene	12	U	10	U	0.012	U
75252	Bromoform	12	U	10	U	0.012	U
108101	4-Methyl-2-pentanone	12	UJ	10	U	0.012	U
591786	2-Hexanone	12	UJ	10	U	0.012	UJ
127184	Tetrachloroethene	12	UJ	10	U	0.012	U
79345	1,1,2,2-Tetrachloroethane	12	UJ	10	U	0.012	U
108883	Toluene	2	B	10	U	0.012	U
108907	Chlorobenzene	12	UJ	10	U	0.012	U
100414	Ethylbenzene	12	UJ	10	U	0.012	U
100425	Styrene	12	UJ	10	U	0.012	U
1330207	Xylene (total)	12	UJ	10	U	0.012	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994. These adjusted results were utilized for comparison with site samples.

**Background Samples - U.S. EPA CLP
Semi-Volatile Organic Analysis Data Sheet**

Site Name: Penniman Shell Loading Plant
All units in mg/kg (solid) or ug/L (liquid)

CAS#	Compound	Soil Sample ID:		Surface Water Sample ID:		Sediment Sample ID:	
		PEN1-SO-15		PEN1-SW-03		PEN1-SED-09	
		Results	Q	Results	Q	Results	Q
108952	Phenol	390	U	10	U	0.4	U
111444	bis(2-Chloroethyl) ether	390	U	10	U	0.4	U
95578	2-Chlorophenol	390	U	10	U	0.4	U
541731	1,3-Dichlorobenzene	390	U	10	U	0.4	U
106467	1,4-Dichlorobenzene	390	U	10	U	0.4	U
95501	1,2-Dichlorobenzene	390	U	10	U	0.4	U
95487	2-Methylphenol	390	U	10	U	0.4	U
108601	2,2'-oxybis(1-Chloropropane)	390	U	10	U	0.4	U
106445	4-Methylphenol	390	U	10	U	0.4	U
621647	N-Nitroso-di-n-propylamine	390	U	10	U	0.4	U
67721	Hexachloroethane	390	U	10	U	0.4	U
98953	Nitrobenzene	390	U	10	U	0.4	U
78591	Isophorone	390	U	10	U	0.4	U
88755	2-Nitrophenol	390	U	10	U	0.4	U
105679	2,4-Dimethylphenol	390	U	10	U	0.4	U
111911	bis(2-Chloroethoxy) methane	390	U	10	U	0.4	U
120832	2,4-Dichlorophenol	390	U	10	U	0.4	U
120821	1,2,4-Trichlorobenzene	390	U	10	U	0.4	U
91203	Naphthalene	390	U	10	U	0.4	U
106478	4-Chloroaniline	390	U	10	U	0.4	U
87683	Hexachlorobutadiene	390	U	10	U	0.4	U
59507	4-Chloro-3-methylphenol	390	U	10	U	0.4	U
91576	2-Methylnaphthalene	390	U	10	U	0.4	U
77474	Hexachlorocyclopentadiene	390	U	10	U	0.4	U
88062	2,4,6-Trichlorophenol	390	U	10	U	0.4	U
95954	2,4,5-Trichlorophenol	950	U	25	U	0.96	U
91587	2-Chloronaphthalene	390	U	10	U	0.4	U
88744	2-Nitroaniline	950	U	25	U	0.96	U
131113	Dimethylphthalate	390	U	10	U	0.4	U
208968	Acenaphthylene	390	U	10	U	0.4	U
606202	2,6-Dinitrotoluene	950	U	10	U	0.4	U
99092	3-Nitroaniline	950	U	25	U	0.96	U
83329	Acenaphthene	390	U	10	U	0.4	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994. These adjusted results were utilized for comparison with site samples.

**Background Samples - U.S. EPA CLP
Semi-Volatile Organic Analysis Data Sheet (continued)**

Site Name: Penniman Shell Loading Plant

All units in mg/kg (solid) or ug/L (liquid)

		Soil Sample ID:		Surface Water Sample ID:		Sediment Sample ID:	
		PEN1-SO-15		PEN1-SW-03		PEN1-SED-09	
CAS#	Compound	Results	Q	Results	Q	Results	Q
51285	2,4-Dinitrophenol	950	U	25	U	0.96	U
100027	4-Nitrophenol	950	U	25	U	0.96	U
132649	Dibenzofuran	390	U	10	U	0.4	U
121142	2,4-Dinitrotoluene	390	U	10	U	0.4	U
84662	Diethylphthalate	390	U	10	U	0.4	U
7005723	4-Chlorophenyl-phenylether	390	U	10	U	0.4	U
86737	Fluorene	390	U	10	U	0.4	U
100016	4-Nitroaniline	950	U	25	U	0.96	U
534521	4,6-Dinitro-2-methylphenol	950	U	25	U	0.96	U
86306	N-Nitrosodiphenylamine	390	U	10	U	0.4	U
101553	4-Bromophenyl-phenylether	390	U	10	U	0.4	U
118741	Hexachlorobenzene	390	U	10	U	0.4	U
87865	Pentachlorophenol	950	U	25	U	0.96	U
85018	Phenanthrene	390	U	10	U	0.4	U
120127	Anthracene	390	U	10	U	0.4	U
86748	Carbazole	390	U	10	U	0.4	U
84742	Di-n-butylphthalate	390	U	10	U	0.4	U
206440	Fluoranthene	390	U	10	U	0.4	U
129000	Pyrene	390	U	10	U	0.4	U
85687	Butylbenzylphthalate	390	U	10	U	0.4	U
91941	3,3'-Dichlorobenzidine	390	U	10	U	0.4	U
56553	Benzo(a)anthracene	390	U	10	U	0.4	U
218019	Chrysene	390	U	10	U	0.4	U
117817	bis(2-Ethylhexyl)phthalate	97	B	10	U	0.34	B
117840	Di-n-octylphthalate	89	B	10	U	0.38	B
205992	Benzo(b)fluoranthene	390	U	10	U	0.4	U
207089	Benzo(k)fluoranthene	390	U	10	U	0.4	U
50328	Benzo(a)pyrene	390	U	10	U	0.4	U
193395	Indeno(1,2,3-cd)pyrene	390	U	10	U	0.4	U
53703	Dibenz(a,h)anthracene	390	U	10	U	0.4	U
191242	Benzo(g,h,i)perylene	390	U	10	U	0.4	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive

9285.7-14FS, "Using Qualified Data to Document an Observed Release -

Quick Reference Fact Sheet" July 1994. These adjusted results were utilized for comparison with site samples.

Background Samples - U.S. EPA CLP
Nitroaromatic and Mustard Decomposition Analyses Data Sheet

Site Name: Penniman Shell Loading Plant

All units in mg/kg (solid) or ug/L (liquid)		Soil Sample ID: PEN1-SO-15		Surface Water Sample ID: PEN1-SW-03		Sediment Sample ID: PEN1-SED-09	
CAS#	Compound	Results	Q	Results	Q	Results	Q
	HMX	2.2	U	NA	-	2.2	U
	1,3,5-Trinitrobenzene	0.25	U	NA	-	0.25	U
	RDX	1	U	NA	-	1	U
	1,3-Dinitrobenzene	0.25	U	NA	-	0.25	U
	Nitrobenzene	0.26	U	NA	-	0.26	U
	2,4,6-Trinitrotoluene	0.25	U	NA	-	0.25	U
	Tetryl	0.65	U	NA	-	0.65	U
	2,4-Dinitrotoluene	0.25	U	NA	-	0.25	U
	2,6-Dinitrotoluene	0.26	U	NA	-	0.26	U
	2-Amino-4,6-dinitrotoluene	0.25	U	NA	-	0.25	U
	4-Amino-2,6-dinitrotoluene	0.25	U	NA	-	0.25	U
	2-Nitrotoluene	0.25	U	NA	-	0.25	U
	4-Nitrotoluene	0.25	U	NA	-	0.25	U
	3-Nitrotoluene	0.25	U	NA	-	0.25	U
	Bis(2-chloroethyl) sulfide (HD)	NA	-	NA	-	NA	-
	1,4-Dithiane	NA	-	NA	-	NA	-
	1,4-Oxathiane	NA	-	NA	-	NA	-

Note 1: NA in the results column indicates that this compound was not analyzed for in the sample.

**Site Soil Sample Summaries - U.S. EPA CLP
Inorganic Analysis Data Sheet**

Site Name: **Penniman Shell Loading Plant**

All units in mg/kg

CAS#	Sample ID No.	PEN1-SO-01		PEN1-SO-03		PEN1-SO-03A		PEN1-SO-04		PEN1-SO-05		PEN1-SO-06		PEN1-SO-07	
	Compound	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
7429905	Aluminum	9050	-	2510	-	2730	-	7760	-	5150	-	3500	-	3080	-
7440360	Antimony	0.94	B	2.9	B	2.2	B		UL		UL	2.9	L	4.6	L
7440382	Arsenic	6	-	12.5	-	15.5	-	11	-	3.5	-	17.9	-	33.4	-
7440393	Barium	16.8	-	183	-	203	-	34.5	-	11.7	-	145	-	261	-
7440417	Beryllium	0.24	-	0.18	-	0.17	-	0.36	-	0.19	-	0.45	-	0.6	-
7440439	Cadmium		-	4	-	4	-		UL		UL	1.5	-		UL
7440702	Calcium	87.5	J	7983.33	J	7633.33	J	768.33	J	320	J	2625	J	7241.67	J
7440473	Chromium	14.8	-	14.8	-	22.7	-	15.1	-	10.2	-	8.2	-	32.9	-
7440484	Cobalt	2	-	5.3	-	6.4	-	2.4	-	0.95	-	7.1	-	14.9	-
7440508	Copper	3.8	-	27.9	-	32.1	-	4.09	J	2.27	J	83.91	J	127.27	J
7439896	Iron	13900	-	70800	-	101000	-	20000	-	9850	-	66100	-	256000	-
7439921	Lead	15	-	7580	-	7750	-	813	-	4.4	-	1720	-	2600	-
7439954	Magnesium	408.33	J	605	J	900	J	648	-	675	-	740	-	824	-
7439965	Manganese	25.1	-	705	-	886	-	65.42	J	15.58	J	286.67	J	1725	J
7439976	Mercury	0.26	-	0.49	-	0.6	-	0.07	-		-		-	0.07	-
7440020	Nickel	4.3	-	15.6	-	17.4	-	5.4	-	1.3	-	25.6	-	34.1	-
7440097	Potassium	419	-	485	-	570	-	722	-	1280	-	389	-	607	-
7782492	Selenium		UL	3.9	-	3.7	L		-		-	1.9	K	3.6	-
7440224	Silver	0.45	-	2.7	-	4	-	0.76	-	0.32	-	2.7	-	9.1	-
7440235	Sodium	57.4	-	147	-	168	-	74.7	-	544	-	152	-	356	-
7440280	Thallium		UL		UL		UL		UL		UL		UL		UL
7440622	Vanadium	25.1	-	28	-	31.8	-	22.5	-	16.6	-	11.1	-	18.4	-
7440666	Zinc	13.4	-	1010	-	1150	-	87.69	J	22.38	J	533.08	J	110.77	J
74908	Cyanide		UL	0.57	-	1.2	-	0.07	L		UL	0.4	L	0.64	L

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Soil Sample Summaries - U.S. EPA CLP
Inorganic Analysis Data Sheet**

Site Name: **Penniman Shell Loading Plant**

All units in mg/kg

CAS#	Compound	PEN1-SO-09		PEN1-SO-10		PEN1-SO-11		PEN1-SO-12		PEN1-SO-13		PEN1-SO-14	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
7429905	Aluminum	3920	-	4610	-	15900	-	11800	-	11600	-	9640	-
7440360	Antimony		UL		UL		UL		UL		UL		UL
7440382	Arsenic	3.5	-	2.8	-	11.9	-	11.8	-	4.7	-	5.5	-
7440393	Barium	39.5	-	40.2	-	35	-	32.2	-	50.4	-	41.9	-
7440417	Beryllium	0.47	-	0.5	-	1.3	-	1.3	-	0.52	-	0.52	-
7440439	Cadmium		UL	1	-		UL		UL		UL	0.22	-
7440702	Calcium	2741.67	J	1033.33	J	2833.33	J	1875	J	2050	J	1925	J
7440473	Chromium	8.5	-	7.3	-	49.3	-	36.3	-	21	-	20.2	-
7440484	Cobalt	2.1	-	2.7	-	4.2	-	3.9	-	2.8	-	1.8	-
7440508	Copper	3.27	J	8.27	J	6.91	J	4.82	J	9.82	J	3.91	J
7439896	Iron	9340	-	7640	-	46700	-	38100	-	18500	-	23300	-
7439921	Lead	42.3	-	28.9	-	13.4	-	9.8	-	23.6	-	12.9	-
7439954	Magnesium	607	-	547	-	4160	-	3610	-	1090	-	977	-
7439965	Manganese	95.83	J	122.5	J	81.58	J	67	J	100	J	29.92	J
7439976	Mercury		-		-		-		-		-		-
7440020	Nickel	3	-	2.7	-	9.9	-	7.6	-	5.9	-	3.7	-
7440097	Potassium	785	-	577	-	5730	-	5480	-	836	-	850	-
7782492	Selenium		-	0.8	K		-		-		-	1.1	K
7440224	Silver	0.31	-	0.61	-	1.5	-	1.4	-	0.77	-	1	-
7440235	Sodium	53.7	-	60.1	-	107	-	116	-	94.5	-	75.2	-
7440280	Thallium		UL		UL		UL		UL		UL		UL
7440622	Vanadium	13.2	-	11.9	-	47.9	-	40	-	25.7	-	26.3	-
7440666	Zinc	30.77	J	109.23	J	33.38	J	26.92	J	31.85	J	138.46	J
74908	Cyanide	0.07	L	0.07	L		UL	0.08	L		UL		UL

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Soil Sample Summaries - U.S. EPA CLP
Pesticide/Polychlorinated Biphenyl Analysis Data Sheet**

Site Name: **Penniman Shell Loading Plant**

All units in ug/kg

CAS#	Sample ID No. Compound	PEN1-SO-01		PEN1-SO-03		PEN1-SO-03A		PEN1-SO-04		PEN1-SO-05		PEN1-SO-06		PEN1-SO-07	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
319846	alpha-HCH	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
319857	beta-HCH	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
319868	delta-HCH	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
58899	gamma-HCH (Lindane)	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
76448	Heptachlor	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
309002	Aldrin	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
1024573	Heptachlor epoxide	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
959988	Endosulfan I	2.1	U	16	J	14	J	11	J	1.9	U	2.2	U	2.5	U
60571	Dieldrin	4.1	U	66	U	135	J	80	U	3.8	U	4.3	U	4.8	U
72559	4,4'-DDE	0.066	J	0.9	J	1.2	J	0.48	J	3.8	U	0.16	J	0.12	J
72208	Endrin	4.1	U	4	J	67	U	80	U	3.8	U	4.3	U	0.15	J
33213659	Endosulfan II	4.1	U	0.43	J	67	U	80	U	3.8	U	4.3	U	4.8	U
72548	4,4'-DDD	4.1	U	0.72	J	67	U	80	U	3.8	U	0.46	J	0.45	J
1031078	Endosulfan sulfate	4.1	U	66	U	67	U	80	U	3.8	U	4.3	U	4.8	U
50293	4,4'-DDT	4.1	U	66	U	67	U	80	U	3.8	U	4.3	U	4.8	U
72435	Methoxychlor	21	U	340	U	350	U	410	U	19	U	22	U	25	U
53494705	Endrin ketone	4.1	U	1.2	J	1.8	J	80	U	3.8	U	0.35	J	0.16	J
7421363	Endrin aldehyde	4.1	U	66	U	67	U	80	U	3.8	U	0.3	J	0.3	J
5103719	alpha-Chlordane	0.18	J	34	U	35	U	41	U	1.9	U	0.14	J	2.5	U
5103742	gamma-Chlordane	2.1	U	34	U	35	U	41	U	1.9	U	2.2	U	2.5	U
8001352	Toxaphene	210	U	3400	U	3500	U	4100	U	190	U	220	U	250	U
12674112	Aroclor-1016	210	U	660	U	670	U	800	U	38	U	43	U	48	U
11104282	Aroclor-1221	41	U	1300	U	1400	U	1600	U	76	U	88	U	97	U
11141165	Aroclor-1232	83	U	660	U	670	U	800	U	38	U	43	U	48	U
53469219	Aroclor-1242	41	U	660	U	670	U	800	U	38	U	43	U	48	U
12672296	Aroclor-1248	41	U	660	U	670	U	800	U	38	U	43	U	48	U
11097691	Aroclor-1254	41	U	660	U	670	U	800	U	38	U	43	U	48	U
11096825	Aroclor-1260	41	U	660	U	670	U	800	U	38	U	43	U	48	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Soil Sample Summaries - U.S. EPA CLP
Pesticide/Polychlorinated Biphenyl Analysis Data Sheet**

Site Name: **Penniman Shell Loading Plant**

All units in mg/kg

CAS#	Sample ID No.	PEN1-SO-09		PEN1-SO-10		PEN1-SO-11		PEN1-SO-12		PEN1-SO-13		PEN1-SO-14	
		Compound	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q	Adj. Result
319846		alpha-HCH	21	U	2	U	2.2	U	2.1	U	2	U	2
319857		beta-HCH	21	U	2	U	2.2	U	2.1	U	2	U	2
319868		delta-HCH	21	U	2	U	2.2	U	2.1	U	2	U	2
58899		gamma-HCH (Lindane)	21	U	2	U	2.2	U	2.1	U	2	U	2
76448		Heptachlor	21	U	2	U	2.2	U	2.1	U	2	U	2
309002		Aldrin	0.265822785	J	2	U	2.2	U	2.1	U	2	U	2
1024573		Heptachlor epoxide	21	U	2	U	2.2	U	2.1	U	2	U	2
959988		Endosulfan I	4.2	J	2	U	2.2	U	2.1	U	2	U	2
605711		Dieldrin	0.387096774	J	2	U	4.3	U	4.1	U	3.8	U	3.8
72559		4,4'-DDE	0.3	J	0.088	J	4.3	U	4.1	U	0.02	J	0.017
72208		Endrin	1.152941176	J	3.9	U	4.3	U	4.1	U	3.8	U	3.8
33213659		Endosulfan II	41	U	3.9	U	4.3	U	4.1	U	3.8	U	3.8
72548		4,4'-DDD	41	U	3.9	U	4.3	U	4.1	U	3.8	U	0.046
1031078		Endosulfan sulfate	41	U	3.9	U	4.3	U	4.1	U	3.8	U	3.8
50293		4,4'-DDT	41	U	0.017567568	J	4.3	U	4.1	U	3.8	U	3.8
72435		Methoxychlor	210	U	20	U	22	U	21	U	20	U	0.1
53494705		Endrin ketone	41	U	0.02	J	4.3	U	4.1	U	3.8	U	3.8
7421363		Endrin aldehyde	41	U	0.076	J	4.3	U	4.1	U	3.8	U	0.033
5103719		alpha-Chlordane	21	U	2	U	2.2	U	2.1	U	2	U	2
5103742		gamma-Chlordane	21	U	2	U	2.2	U	2.1	U	2	U	2
8001352		Toxaphene	2100	U	200	U	220	U	210	U	200	U	200
12674112		Aroclor-1016	410	U	39	U	43	U	41	U	38	U	38
11104282		Aroclor-1221	840	U	80	U	87	U	84	U	78	U	77
11141165		Aroclor-1232	410	U	39	U	43	U	41	U	38	U	38
53469219		Aroclor-1242	410	U	39	U	43	U	41	U	38	U	38
12672296		Aroclor-1248	410	U	39	U	43	U	41	U	38	U	38
11097691		Aroclor-1254	410	U	39	U	43	U	41	U	38	U	38
11096825		Aroclor-1260	410	U	39	U	43	U	41	U	38	U	38

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Soil Sample Summaries - U.S. EPA CLP
Volatile Organic Analysis Data Sheet**

Site Name: Penniman Shell Loading Plant

All units in ug/kg

CAS#	Sample ID No.	PEN1-SO-01		PEN1-SO-03		PEN1-SO-03A		PEN1-SO-04		PEN1-SO-05		PEN1-SO-06		PEN1-SO-07	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
74873	Chloromethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
74839	Bromomethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75014	Vinyl chloride	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75003	Chloroethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75092	Methylene chloride	9	B	14	B	11	B	8	B	3	B	15	B	14	U
67641	Acetone	62.14	J	27	B	20	UJ	12	U	11	UJ	13	UJ	14	U
75150	Carbon disulfide	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75354	1,1-Dichloroethene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75343	1,1-Dichloroethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
540590	1,2-Dichloroethene (total)	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
67663	Chloroform	4	B	3	B	10	J	12	U	11	U	5	B	14	U
107062	1,2-Dichloroethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
78933	2-Butanone (MEK)	12	UJ	20	U	20	UJ	12	U	11	UJ	13	UJ	14	U
71556	1,1,1-Trichloroethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
56235	Carbon tetrachloride	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75274	Bromodichloromethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
78875	1,2-Dichloropropane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
542756	1,3-Dichloropropene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
79016	Trichloroethene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
124481	Dibromochloromethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
79005	1,1,2-Trichloroethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
71432	Benzene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
75252	Bromoform	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
108101	4-Methyl-2-pentanone	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
591786	2-Hexanone	12	U	20	U	20	UJ	12	U	11	UJ	13	UJ	14	U
127184	Tetrachloroethene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
79345	1,1,2,2-Tetrachloroethane	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
108883	Toluene	3	B	20	U	20	UJ	12	U	11	U	3	B	14	U
108907	Chlorobenzene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
100414	Ethylbenzene	12	U	20	U	20	UJ	12	U	11	U	13	UJ	14	U
100425	Styrene	12	U	2.666666667	J	20	UJ	12	U	11	U	13	UJ	14	U
1330207	Xylene (total)	2	J	20	U	20	UJ	12	U	11	U	13	UJ	14	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

Site Soil Sample Summaries - U.S. EPA CLP
Volatile Organic Analysis Data Sheet

Site Name: Penniman Shell Loading Plant

All units in mg/kg

Sample ID No.	PEN1-SO-09		PEN1-SO-10		PEN1-SO-11		PEN1-SO-12		PEN1-SO-13		PEN1-SO-14		
CAS#	Compound	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q
74873	Chloromethane	12	U	12	U	13	U	12	U	12	U	11	U
74839	Bromomethane	12	U	12	U	13	U	12	U	12	U	11	U
75014	Vinyl chloride	12	U	12	U	13	U	12	U	12	U	11	U
75003	Chloroethane	12	U	12	U	13	U	12	U	12	U	11	U
75092	Methylene chloride	3	B	8	B	11	B	11	B	3	B	5	B
67641	Acetone	20	B	12	U	13	U	12	UJ	12	UJ	11	UJ
75150	Carbon disulfide	12	U	12	U	13	U	12	U	12	U	11	U
75354	1,1-Dichloroethene	12	U	12	U	13	U	12	U	12	U	11	U
75343	1,1-Dichloroethane	12	U	12	U	13	U	12	U	12	U	11	U
540590	1,2-Dichloroethene (total)	12	U	12	U	13	U	12	U	12	U	11	U
67663	Chloroform	12	U	12	U	13	U	2	B	12	U	1	B
107062	1,2-Dichloroethane	12	U	12	U	13	U	12	U	12	U	11	U
78933	2-Butanone (MEK)	12	UJ	12	U	13	U	12	UJ	12	UJ	11	UJ
71556	1,1,1-Trichloroethane	12	U	12	U	13	U	12	U	12	U	11	U
56235	Carbon tetrachloride	12	U	12	U	13	U	12	U	12	U	11	U
75274	Bromodichloromethane	12	U	12	U	13	U	12	U	12	U	11	U
78875	1,2-Dichloropropane	12	U	12	U	13	U	12	U	12	U	11	U
542756	1,3-Dichloropropene	12	U	12	U	13	U	12	U	12	U	11	U
79016	Trichloroethene	12	U	12	U	13	U	12	U	12	U	11	U
124481	Dibromochloromethane	12	U	12	U	13	U	12	U	12	U	11	U
79005	1,1,2-Trichloroethane	12	U	12	U	13	U	12	U	12	U	11	U
71432	Benzene	12	U	12	U	13	U	12	U	12	U	11	U
75252	Bromoform	12	U	12	U	13	U	12	U	12	U	11	U
108101	4-Methyl-2-pentanone	12	U	12	U	13	U	12	U	12	U	11	U
591786	2-Hexanone	12	UJ	12	U	13	U	12	U	12	UJ	11	UJ
127184	Tetrachloroethene	12	U	12	U	13	U	12	U	12	U	11	U
79345	1,1,2,2-Tetrachloroethane	12	U	12	U	13	U	12	U	12	U	11	U
108883	Toluene	12	U	12	U	13	U	12	U	12	U	11	U
108907	Chlorobenzene	12	U	12	U	13	U	12	U	12	U	11	U
100414	Ethylbenzene	12	U	12	U	13	U	12	U	12	U	11	U
100425	Styrene	12	U	12	U	13	U	12	U	12	U	11	U
1330207	Xylene (total)	12	U	12	U	13	U	12	U	12	U	11	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Soil Sample Summaries- U.S. EPA CLP
Semi-Volatile Organic Analysis Data Sheet**

Site Name: **Penniman Shell Loading Plant**

All units in ug/kg

CAS#	Sample ID No. Compound	PEN1-SO-01		PEN1-SO-03		PEN1-SO-03A		PEN1-SO-04		PEN1-SO-05		PEN1-SO-06		PEN1-SO-07	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
108952	Phenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
111444	bis(2-Chloroethyl) ether	410	U	660	U	670	U	400	U	380	U	430	U	480	U
95578	2-Chlorophenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
541731	1,3-Dichlorobenzene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
106467	1,4-Dichlorobenzene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
95501	1,2-Dichlorobenzene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
95487	2-Methylphenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
108601	2,2'-oxybis(1-Chloropropane)	410	U	660	U	670	U	400	U	380	U	430	U	480	U
106445	4-Methylphenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
621647	N-Nitroso-di-n-propylamine	410	U	660	U	670	U	400	U	380	U	430	U	480	U
67721	Hexachloroethane	410	U	660	U	670	U	400	U	380	U	430	U	480	U
98953	Nitrobenzene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
78591	Isophorone	410	U	660	U	670	U	400	U	380	U	430	U	480	U
88755	2-Nitrophenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
105679	2,4-Dimethylphenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
111911	bis(2-Chloroethoxy) methane	410	U	660	U	670	U	400	U	380	U	430	U	480	U
120832	2,4-Dichlorophenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
120821	1,2,4-Trichlorobenzene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
91203	Naphthalene	410	U	660	U	670	U	400	U	380	U	430	U	21.5	J
106478	4-Chloroaniline	410	U	660	U	670	U	400	U	380	U	430	U	480	U
87683	Hexachlorobutadiene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
59507	4-Chloro-3-methylphenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
91576	2-Methylnaphthalene	410	U	660	U	670	U	400	U	380	U	430	U	45	J
77474	Hexachlorocyclopentadiene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
88062	2,4,6-Trichlorophenol	410	U	660	U	670	U	400	U	380	U	430	U	480	U
95954	2,4,5-Trichlorophenol	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
91587	2-Chloronaphthalene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
88744	2-Nitroaniline	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
131113	Dimethylphthalate	410	U	660	U	670	U	400	U	380	U	430	U	480	U
208968	Acenaphthylene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
606202	2,6-Dinitrotoluene	410	U	660	U	670	U	14.61	J	910	U	1000	U	480	U
99092	3-Nitroaniline	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
83329	Acenaphthene	410	U	660	U	670	U	400	U	380	U	430	U	480	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Soil Sample Summaries- U.S. EPA CLP
Semi-Volatile Organic Analysis Data Sheet (continued)**

Site Name: **Penniman Shell Loading Plant**

All units in ug/kg

CAS#	Sample ID No.	PEN1-SO-01		PEN1-SO-03		PEN1-SO-03A		PEN1-SO-04		PEN1-SO-05		PEN1-SO-06		PEN1-SO-07	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
51285	2,4-Dinitrophenol	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
100027	4-Nitrophenol	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
132649	Dibenzofuran	410	U	660	U	670	U	400	U	380	U	430	U	9.10	J
121142	2,4-Dinitrotoluene	410	U	660	U	670	U	111.76	J	380	U	430	U	480	U
84662	Diethylphthalate	410	U	660	U	670	U	400	U	380	U	430	U	480	U
7005723	4-Chlorophenyl-phenylether	410	U	660	U	670	U	400	U	380	U	430	U	480	U
86737	Fluorene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
100016	4-Nitroaniline	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
534521	4,6-Dinitro-2-methylphenol	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
86306	N-Nitrosodiphenylamine	410	U	660	U	670	U	400	U	380	U	430	U	480	U
101553	4-Bromophenyl-phenylether	410	U	660	U	670	U	400	U	380	U	430	U	480	U
118741	Hexachlorobenzene	410	U	660	U	670	U	400	U	380	U	430	U	480	U
87865	Pentachlorophenol	990	U	1600	U	1600	U	960	U	910	U	1000	U	1200	U
85018	Phenanthrene	410	U	42	J	34	J	2.8	J	380	U	3.5	J	24	J
120127	Anthracene	410	U	660	U	670	U	3.6	J	380	U	430	U	480	U
86748	Carbazole	410	U	660	U	670	U	400	U	380	U	430	U	480	U
84742	Di-n-butylphthalate	410	U	660	U	670	U	400	U	380	U	430	U	480	U
206440	Fluoranthene	410	U	42	J	48	J	25	J	380	U	430	U	3	J
129000	Pyrene	410	U	1300	-	1500	-	510	-	380	U	3.49	J	5.18	J
85687	Butylbenzylphthalate	410	U	660	U	670	U	400	U	380	U	430	U	480	U
91941	3,3'-Dichlorobenzidine	410	U	660	U	670	U	400	U	380	U	430	U	480	U
56553	Benzo(a)anthracene	410	U	97.67	J	125.58	J	21.86	J	380	U	6.51	J	7.21	J
218019	Chrysene	410	U	740	-	840	-	30.23	J	380	U	13.26	J	15.81	J
117817	bis(2-Ethylhexyl)phthalate	140	B	200	B	140	B	190	B	140	B	430	U	130	B
117840	Di-n-octylphthalate	130	B	150	B	57	B	200	B	140	B	170	B	110	B
205992	Benzo(b)fluoranthene	410	U	33	J	38	J	3.6	J	380	U	12	J	6.1	J
207089	Benzo(k)fluoranthene	410	U	31	J	37	J	4.5	J	380	U	8.2	J	5.7	J
50328	Benzo(a)pyrene	410	U	47	J	55	J	400	U	380	U	6.4	J	480	U
193395	Indeno(1,2,3-cd)pyrene	410	U	22.47	J	22.47	J	400	U	380	U	26.97	J	7.64	J
53703	Dibenz(a,h)anthracene	410	U	15.73	J	19.10	J	400	U	380	U	7.87	J	480	U
191242	Benzo(g,h,i)perylene	410	U	26	J	35	J	400	U	380	U	28	J	9.6	J

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Soil Sample Summaries- U.S. EPA CLP
Semi-Volatile Organic Analysis Data Sheet**

Site Name: **Penniman Shell Loading Plant**

All units in mg/kg

CAS#	Compound	PEN1-SO-09		PEN1-SO-10		PEN1-SO-11		PEN1-SO-12		PEN1-SO-13		PEN1-SO-14	
		Adj. Result	Q	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q
108952	Phenol	410	U	390	U	430	U	410	U	380	U	380	
111444	bis(2-Chloroethyl) ether	410	U	390	U	430	U	410	U	380	U	380	
95578	2-Chlorophenol	410	U	390	U	430	U	410	U	380	U	380	
541731	1,3-Dichlorobenzene	410	U	390	U	430	U	410	U	380	U	380	
106467	1,4-Dichlorobenzene	410	U	390	U	430	U	410	U	380	U	380	
95501	1,2-Dichlorobenzene	410	U	390	U	430	U	410	U	380	U	380	
95487	2-Methylphenol	410	U	390	U	430	U	410	U	380	U	380	
108601	2,2'-oxybis(1-Chloropropane)	410	U	390	U	430	U	410	U	380	U	380	
106445	4-Methylphenol	410	U	390	U	430	U	410	U	380	U	380	
621647	N-Nitroso-di-n-propylamine	410	U	390	U	430	U	410	U	380	U	380	
67721	Hexachloroethane	410	U	390	U	430	U	410	U	380	U	380	
98953	Nitrobenzene	410	U	390	U	430	U	410	U	380	U	380	
78591	Isophorone	410	U	390	U	430	U	410	U	380	U	380	
88755	2-Nitrophenol	410	U	390	U	430	U	410	U	380	U	380	
105679	2,4-Dimethylphenol	410	U	390	U	430	U	410	U	380	U	380	
111911	bis(2-Chloroethoxy) methane	410	U	390	U	430	U	410	U	380	U	380	
120832	2,4-Dichlorophenol	410	U	390	U	430	U	410	U	380	U	380	
120821	1,2,4-Trichlorobenzene	410	U	390	U	430	U	410	U	380	U	380	
91203	Naphthalene	410	U	390	U	430	U	410	U	380	U	380	
106478	4-Chloroaniline	410	U	390	U	430	U	410	U	380	U	380	
87683	Hexachlorobutadiene	410	U	390	U	430	U	410	U	380	U	380	
59507	4-Chloro-3-methylphenol	410	U	390	U	430	U	410	U	380	U	380	
91576	2-Methylnaphthalene	410	U	390	U	430	U	410	U	380	U	380	
77474	Hexachlorocyclopentadiene	410	U	390	U	430	U	410	U	380	U	380	
88062	2,4,6-Trichlorophenol	410	U	390	U	430	U	410	U	380	U	380	
95954	2,4,5-Trichlorophenol	1000	U	950	U	1000	U	1000	U	930	U	920	
91587	2-Chloronaphthalene	410	U	390	U	430	U	410	U	380	U	380	
88744	2-Nitroaniline	1000	U	950	U	1000	U	1000	U	930	U	920	
131113	Dimethylphthalate	410	U	390	U	430	U	410	U	380	U	380	
208968	Acenaphthylene	410	U	390	U	430	U	410	U	380	U	380	
606202	2,6-Dinitrotoluene	1000	U	950	U	1000	U	1000	U	930	U	920	
99092	3-Nitroaniline	1000	U	950	U	1000	U	1000	U	930	U	920	
83329	Acenaphthene	410	U	390	U	430	U	410	U	380	U	380	

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

Site Soil Sample Summaries- U.S. EPA CLP
Semi-Volatile Organic Analysis Data Sheet (continued)

Site Name: Penniman Shell Loading Plant

All units in ug/kg

	Sample ID No.	PEN1-SO-09		PEN1-SO-10		PEN1-SO-11		PEN1-SO-12		PEN1-SO-13		PEN1-SO-14	
CAS#	Compound	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q	Adj. Result	Q
51285	2,4-Dinitrophenol	1000	U	950	U	1000	U	1000	U	930	U	920	U
100027	4-Nitrophenol	1000	U	950	U	1000	U	1000	U	930	U	920	U
132649	Dibenzofuran	410	U	390	U	430	U	410	U	380	U	380	U
121142	2,4-Dinitrotoluene	410	U	390	U	430	U	410	U	380	U	380	U
84662	Diethylphthalate	410	U	390	U	430	U	410	U	3.26	J	380	U
7005723	4-Chlorophenyl-phenylether	410	U	390	U	430	U	410	U	380	U	380	U
86737	Fluorene	410	U	390	U	430	U	410	U	380	U	380	U
100016	4-Nitroaniline	1000	U	950	U	1000	U	1000	U	930	U	920	U
534521	4,6-Dinitro-2-methylphenol	1000	U	950	U	1000	U	1000	U	930	U	920	U
86306	N-Nitrosodiphenylamine	410	U	390	U	430	U	410	U	380	U	380	U
101553	4-Bromophenyl-phenylether	410	U	390	U	430	U	410	U	380	U	380	U
118741	Hexachlorobenzene	410	U	390	U	430	U	410	U	380	U	380	U
87865	Pentachlorophenol	1000	U	950	U	1000	U	1000	U	930	U	920	U
85018	Phenanthrene	410	U	390	U	430	U	410	U	380	U	380	U
120127	Anthracene	410	U	390	U	430	U	410	U	380	U	380	U
86748	Carbazole	410	U	390	U	430	U	410	U	380	U	380	U
84742	Di-n-butylphthalate	410	U	390	U	2.6	J	2.6	J	17	J	380	U
206440	Fluoranthene	410	U	2.5	J	430	U	410	U	380	U	380	U
129000	Pyrene	410	U	3.98	J	430	U	410	U	380	U	380	U
85687	Butylbenzylphthalate	410	U	390	U	430	U	410	U	380	U	380	U
91941	3,3'-Dichlorobenzidine	410	U	390	U	430	U	410	U	380	U	380	U
56553	Benzo(a)anthracene	410	U	390	U	430	U	410	U	380	U	380	U
218019	Chrysene	410	U	5.58	J	430	U	410	U	380	U	380	U
117817	bis(2-Ethylhexyl)phthalate	120	B	170	B	260	B	35	B	180	B	180	B
117840	Di-n-octylphthalate	100	B	180	B	300	B	35	B	150	B	200	B
205992	Benzo(b)fluoranthene	410	U	3	J	430	U	410	U	380	U	380	U
207089	Benzo(k)fluoranthene	410	U	2.6	J	430	U	410	U	380	U	380	U
50328	Benzo(a)pyrene	410	U	2.6	J	430	U	410	U	380	U	380	U
193395	Indeno(1,2,3-cd)pyrene	410	U	390	U	430	U	410	U	380	U	380	U
53703	Dibenz(a,h)anthracene	410	U	390	U	430	U	410	U	380	U	380	U
191242	Benzo(g,h,i)perylene	410	U	390	U	430	U	410	U	380	U	380	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Soil Sample Summaries - U.S. EPA CLP
Nitroaromatics and Mustard Decomp. Analyses Data Sheet**

Site Name: Penniman Shell Loading Plant

All units in mg/kg

Sample ID No.	PEN1-SO-01		PEN1-SO-03		PEN1-SO-03A		PEN1-SO-04		PEN1-SO-05		PEN1-SO-06		PEN1-SO-07	
Compound	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
HMX	2.2	U	22	U	22	U	220	U	2.2	U	2.2	U	2.2	U
1,3,5-Trinitrobenzene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U
RDX	1.0	U	10	U	10	U	100	U	1.0	U	1.0	U	1.0	U
1,3-Dinitrobenzene	0.25	U	2.5	U	2.5	U	25.00	U	0.25	U	0.25	U	0.25	U
Nitrobenzene	0.26	U	2.6	U	2.6	U	26	U	0.26	U	0.26	U	0.26	U
2,4,6-Trinitrotoluene	0.25	U	26	U	28	U	620	U	0.25	U	0.25	U	0.25	U
Tetryl	0.65	U	6.5	U	6.5	U	65	U	0.65	U	0.65	U	0.65	U
2,4-Dinitrotoluene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U
2,6-Dinitrotoluene	0.26	U	2.6	U	2.6	U	26	U	0.26	U	0.26	U	0.26	U
2-Amino-4,6-dinitrotoluene	0.25	U	1.8	J	1.8	U	18	U	0.25	U	0.25	U	0.25	U
4-Amino-2,6-dinitrotoluene	0.25	U	1.4	B	1.1	B	11	B	0.25	U	0.25	U	0.25	U
2-Nitrotoluene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U
4-Nitrotoluene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U
3-Nitrotoluene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U
Bis(2-chloroethyl) sulfide (HD)	NA		NA		NA		NA		NA		NA		NA	
1,4-Dithiane	NA		NA		NA		NA		NA		NA		NA	
1,4-Oxathiane	NA		NA		NA		NA		NA		NA		NA	

Note1: NA in results column indicates that this compound was not analyzed for in the sample.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Soil Sample Summaries - U.S. EPA CLP
Nitroaromatics and Mustard Decomp. Analyses Data Sheet**

Site Name: Penniman Shell Loading Plant

All units in mg/kg

Sample ID No.	PEN1-SO-09		PEN1-SO-10		PEN1-SO-11		PEN1-SO-12		PEN1-SO-13		PEN1-SO-14	
Compound	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
HMX	2.2	U	2.2	U	2.2		2.2		2.2		2.2	
1,3,5-Trinitrobenzene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
RDX	1.0	U	1.0	U	1.0		1.0		1.0		1.0	
1,3-Dinitrobenzene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
Nitrobenzene	0.26	U	0.26	U	0.26		0.26		0.26		0.26	
2,4,6-Trinitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
Tetryl	0.65	U	0.65	U	0.65		0.65		0.65		0.65	
2,4-Dinitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
2,6-Dinitrotoluene	0.26	U	0.26	U	0.26		0.26		0.26		0.26	
2-Amino-4,6-dinitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
4-Amino-2,6-dinitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
2-Nitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
4-Nitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
3-Nitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
Bis(2-chloroethyl) sulfide (HD)	0.02	U	0.02	U	NA		NA		NA		NA	
1,4-Dithiane	0.02	U	0.02	U	NA		NA		NA		NA	
1,4-Oxathiane	0.02	U	0.02	U	NA		NA		NA		NA	

Note 1: NA in results column indicates that this compound was not analyzed for in the sample.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Sediment Sample Summaries - U.S. EPA CLP
Inorganic Analysis Data Sheet**

Site Name: Penniman Shell Loading Plant

All units in mg/kg

CAS#	Sample ID No. Compound	PEN1-SED-01		PEN1-SED-02		PEN1-SED-02A		PEN1-SED-04		PEN1-SED-05		PEN1-SED-06		PEN1-SED-07		PEN1-SED-08	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
7429905	Aluminum	9170	-	1270	-	1360	-	5430	-	4650	-	4570	-	7910	-	1670	-
7440360	Antimony	UL	-	UL	-	UL	-	UL	-	1.3	B	UL	-	UL	-	UL	-
7440382	Arsenic	4.8	-	1.4	-	2	-	10.8	-	5.4	-	2.3	-	6.7	-	2.5	-
7440393	Barium	21.8	-	5.5	-	6.5	-	54.7	-	31.8	-	45.2	-	30.2	-	11.3	-
7440417	Beryllium	0.26	-	0.09	-	0.09	-	0.36	-	0.55	-	0.43	-	0.65	-	0.23	-
7440439	Cadmium	-	-	-	-	-	-	-	-	0.25	-	-	-	-	-	-	-
7440702	Calcium	795	J	698.33	J	728.33	J	15583.33333	J	11250	J	858.33	J	621.67	J	3091.67	J
7440473	Chromium	12.1	-	2.6	-	3	-	8.7	-	18.2	-	7.3	-	20.5	-	7.2	-
7440484	Cobalt	1.9	-	-	-	0.45	-	2	-	2.9	-	2.5	-	3.1	-	0.77	-
7440508	Copper	3.2	-	1	B	1.3	B	4.7	-	6.8	-	8.7	-	3.1	-	1.6	B
7439896	Iron	8320	-	1900	-	2170	-	15100	-	12500	-	7660	-	19400	-	3230	-
7439921	Lead	8.1	-	4	-	4.9	-	11	-	5.2	-	52.5	-	11.5	-	3.7	-
7439954	Magnesium	495.83	J	100	J	114.17	J	1100	J	1208.33	J	474.17	J	1266.67	J	362.5	J
7439965	Manganese	23	-	14.5	-	14.1	-	168	-	31	-	220	-	101	-	6.4	-
7439976	Mercury	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7440020	Nickel	4.2	-	0.84	-	1.4	-	3.4	-	6.9	-	3.3	-	5.9	-	1.6	-
7440097	Potassium	416	-	130	-	150	-	548	-	2070	-	474	-	1790	-	579	-
7782492	Selenium	UL	-	UL	-	UL	-	UL	-	UL	-	UL	-	UL	-	UL	-
7440224	Silver	0.23	-	-	-	-	-	0.42	-	0.39	-	0.26	-	0.71	-	-	-
7440235	Sodium	71.8	-	30.2	-	60.7	-	93.5	-	194	-	63.3	-	57.7	-	41.6	-
7440280	Thallium	UL	-	UL	-	UL	-	UL	-	UL	-	UL	-	UL	-	UL	-
7440622	Vanadium	20.2	-	3.6	-	4.2	-	13.6	-	20.5	-	11.6	-	21.9	-	8.2	-
7440666	Zinc	15.5	-	3.9	B	4.4	B	59.6	-	20.8	-	25.4	-	23.1	-	9.2	-
74908	Cyanide	UL	-	UL	-	0.06	L	0.12	L	UL	-	UL	-	0.06	L	UL	-

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Sediment Sample Summaries - U.S. EPA CLP
Pesticide/Polychlorinated Biphenyl Analysis Data Sheet**

Site Name: **Penniman Shell Loading Plant**

All units in ug/kg

CAS#	Sample ID No.	PEN1-SED-01		PEN1-SED-02		PEN1-SED-02A		PEN1-SED-04		PEN1-SED-05		PEN1-SED-06		PEN1-SED-07		PEN1-SED-08	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
319846	alpha-HCH	0.0022	U	0.0023	U	0.0022	U	0.0023	U	0.0024	U	0.002	U	0.0021	U	0.0026	U
319857	beta-HCH	0.0022	U	0.0023	U	0.0022	U	0.0023	U	0.0024	U	0.002	U	0.0021	U	0.0026	U
319868	delta-HCH	0.0022	U	0.0023	U	0.0022	U	0.0023	U	0.0024	U	0.002	U	0.0021	U	0.0026	U
58899	gamma-HCH (Lindane)	0.0022	U	0.0023	U	0.0022	U	0.0023	U	0.0024	U	0.002	U	0.0021	U	0.0026	U
76448	Heptachlor	0.0022	U	0.0023	U	0.0022	U	0.0023	U	0.0024	U	0.002	U	0.0021	U	0.0026	U
309002	Aldrin	0.0022	U	0.0023	U	0.0022	U	0.0023	U	0.0024	U	0.002	U	0.00005	J	0.0026	U
1024573	Heptachlor epoxide	0.0022	U	0.0023	U	0.0022	U	0.0023	U	0.0024	U	0.002	U	0.0021	U	0.0026	U
959988	Endosulfan I	0.0022	U	0.000086	J	0.0022	U	0.0023	U	0.0024	U	0.002	U	0.0021	U	0.00017	J
60571	Dieldrin	0.0042	U	0.000140323	J	0.0043	U	0.0044	U	0.0046	U	0.0039	U	0.0041	U	0.0052	U
72559	4,4'-DDE	0.0042	U	0.000056	J	0.0043	U	0.000054	J	0.0046	U	0.0039	U	0.000031	J	0.0045	J
72208	Endrin	0.0042	U	0.000164706	J	0.00005	J	0.00006	J	0.0046	U	0.0039	U	0.0041	U	0.0052	U
33213659	Endosulfan II	0.0042	U	0.0045	U	0.0043	U	0.000065	J	0.0046	U	0.0039	U	0.0041	U	0.0052	U
72548	4,4'-DDD	0.0042	U	0.0045	U	0.0043	U	0.00023	J	0.0046	U	0.0039	U	0.0041	U	0.015	J
1031078	Endosulfan sulfate	0.0042	U	0.0045	U	0.000047	J	0.0044	U	0.0046	U	0.0039	U	0.0041	U	0.0052	U
50293	4,4'-DDT	0.0042	U	0.000135135	J	0.000121622	J	0.0044	U	0.0046	U	0.0039	U	0.0041	U	0.000256757	J
72435	Methoxychlor	0.022	U	0.023	U	0.00069	B	0.00069	J	0.024	U	0.0006	B	0.0012	B	0.026	U
53494705	Endrin ketone	0.0042	U	0.0045	U	0.0043	U	0.0002	J	0.0046	U	0.0039	U	0.00043	J	0.0052	U
7421363	Endrin aldehyde	0.0042	U	0.000053	J	0.00006	J	0.0044	U	0.0046	U	0.0039	U	0.00016	J	0.0052	U
5103719	alpha-Chlordane	0.0022	U	0.0023	U	0.0022	U	0.0027	-	0.0024	U	0.000063	J	0.00018	J	0.0026	U
5103742	gamma-Chlordane	0.0022	U	0.0023	U	0.0022	U	0.0001	J	0.0024	U	0.002	U	0.000029	J	0.000046	J
8001352	Toxaphene	0.22	U	0.23	U	0.22	U	0.23	U	0.24	U	0.2	U	0.21	U	0.26	U
12674112	Aroclor-1016	0.042	U	0.044	U	0.043	U	0.044	U	0.046	U	0.039	U	0.041	U	0.052	U
11104282	Aroclor-1221	0.086	U	0.09	U	0.087	U	0.089	U	0.093	U	0.08	U	0.083	U	0.1	U
11141165	Aroclor-1232	0.042	U	0.044	U	0.043	U	0.044	U	0.046	U	0.039	U	0.041	U	0.052	U
53469219	Aroclor-1242	0.042	U	0.044	U	0.043	U	0.044	U	0.046	U	0.039	U	0.041	U	0.052	U
12672296	Aroclor-1248	0.042	U	0.044	U	0.043	U	0.044	U	0.046	U	0.039	U	0.041	U	0.052	U
11097691	Aroclor-1254	0.042	U	0.044	U	0.043	U	0.044	U	0.046	U	0.039	U	0.041	U	0.052	U
11096825	Aroclor-1260	0.042	U	0.044	U	0.043	U	0.044	U	0.046	U	0.039	U	0.041	U	0.052	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Sediment Sample Summaries - U.S. EPA CLP
Volatile Organic Analysis Data Sheet**

Site Name: Penniman Shell Loading Plant

All units in ug/kg

	Sample ID No.	PEN1-SED-01		PEN1-SED-02		PEN1-SED-02A		PEN1-SED-04		PEN1-SED-05		PEN1-SED-06		PEN1-SED-07		PEN1-SED-08	
CAS#	Compound	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
74873	Chloromethane	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
74839	Bromomethane	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
75014	Vinyl chloride	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
75003	Chloroethane	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
75092	Methylene chloride	0.014	B	0.007	B	0.006	B	0.01	B	0.003	B	0.012	U	0.012	U	0.004	B
67641	Acetone	0.017	B	0.01	B	0.011	B	0.014	B	0.02	B	0.018	B	0.009	B	0.017	B
75150	Carbon disulfide	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
75354	1,1-Dichloroethene	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
75343	1,1-Dichloroethane	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
540590	1,2-Dichloroethene (total)	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
67663	Chloroform	0.004	B	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
107062	1,2-Dichloroethane	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
78933	2-Butanone (MEK)	0.013	UJ	0.014	U	0.013	U	0.013	U	0.014	UJ	0.012	UJ	0.012	UJ	0.016	UJ
71556	1,1,1-Trichloroethane	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
56235	Carbon tetrachloride	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
75274	Bromodichloromethane	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
78875	1,2-Dichloropropane	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
542756	1,3-Dichloropropene	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
79016	Trichloroethene	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
124481	Dibromochloromethane	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
79005	1,1,2-Trichloroethane	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
71432	Benzene	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
75252	Bromoform	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
108101	4-Methyl-2-pentanone	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
591786	2-Hexanone	0.013	UJ	0.014	U	0.013	U	0.013	U	0.014	UJ	0.012	UJ	0.012	UJ	0.016	UJ
127184	Tetrachloroethene	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
79345	1,1,2,2-Tetrachloroethane	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
108883	Toluene	0.003	B	0.014	B	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
108907	Chlorobenzene	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
100414	Ethylbenzene	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
100425	Styrene	0.013	U	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U
1330207	Xylene (total)	0.002	J	0.014	U	0.013	U	0.013	U	0.014	U	0.012	U	0.012	U	0.016	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Sediment Sample Summaries - U.S. EPA CLP
Semi-Volatile Organic Analysis Data Sheet**

Site Name: **Penniman Shell Loading Plant**

All units in ug/kg

CAS#	Sample ID No. Compound	PEN1-SED-01		PEN1-SED-02		PEN1-SED-02A		PEN1-SED-04		PEN1-SED-05		PEN1-SED-06		PEN1-SED-07		PEN1-SED-08	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
108952	Phenol	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
111444	bis(2-Chloroethyl) ether	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
95578	2-Chlorophenol	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
541731	1,3-Dichlorobenzene	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
106467	1,4-Dichlorobenzene	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
95501	1,2-Dichlorobenzene	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
95487	2-Methylphenol	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
108601	2,2'-oxybis(1-Chloropropane)	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
106445	4-Methylphenol	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
621647	N-Nitroso-di-n-propylamine	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
67721	Hexachloroethane	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
98953	Nitrobenzene	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
78591	Isophorone	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
88755	2-Nitrophenol	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
105679	2,4-Dimethylphenol	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
111911	bis(2-Chloroethoxy) methane	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
120832	2,4-Dichlorophenol	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
120821	1,2,4-Trichlorobenzene	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
91203	Naphthalene	0.42	U	0.44	U	0.43	U	0.00675	J	0.115	J	0.39	U	0.41	U	0.52	U
106478	4-Chloroaniline	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
87683	Hexachlorobutadiene	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
59507	4-Chloro-3-methylphenol	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
91576	2-Methylnaphthalene	0.42	U	0.44	U	0.43	U	0.01275	J	0.115	J	0.39	U	0.41	U	0.52	U
77474	Hexachlorocyclopentadiene	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
88062	2,4,6-Trichlorophenol	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
95954	2,4,5-Trichlorophenol	1	U	1.1	U	1	U	1.1	U	1.1	U	0.95	U	0.99	U	1.2	U
91587	2-Chloronaphthalene	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
88744	2-Nitroaniline	1	U	1.1	U	1	U	1.1	U	1.1	U	0.95	U	0.99	U	1.2	U
131113	Dimethylphthalate	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
208968	Acenaphthylene	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
606202	2,6-Dinitrotoluene	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U
99092	3-Nitroaniline	1	U	1.1	U	1	U	1.1	U	1.1	U	0.95	U	0.99	U	1.2	U
83329	Acenaphthene	0.42	U	0.44	U	0.43	U	0.44	U	0.46	U	0.39	U	0.41	U	0.52	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Sediment Sample Summaries - U.S. EPA CLP
Semi-Volatile Organic Analysis Data Sheet (continued)**

Site Name: Penniman Shell Loading Plant

All units in ug/kg

Sample ID No.	PEN1-SED-01	PEN1-SED-02	PEN1-SED-02A	PEN1-SED-04	PEN1-SED-05	PEN1-SED-06	PEN1-SED-07	PEN1-SED-08	
CAS#	Compound	Results	Q	Results	Q	Results	Q	Results	Q
51285	2,4-Dinitrophenol	1	U	1.1	U	1	U	1.1	U
100027	4-Nitrophenol	1	U	1.1	U	1	U	1.1	U
132649	Dibenzofuran	0.42	U	0.44	U	0.43	U	0.44	U
121142	2,4-Dinitrotoluene	0.42	U	0.44	U	0.43	U	0.44	U
84662	Diethylphthalate	0.42	U	0.44	U	0.43	U	0.44	U
7005723	4-Chlorophenyl-phenylether	0.42	U	0.44	U	0.43	U	0.44	U
86737	Fluorene	0.42	U	0.44	U	0.43	U	0.44	U
100016	4-Nitroaniline	1	U	1.1	U	1	U	1.1	U
534521	4,6-Dinitro-2-methylphenol	1	U	1.1	U	1	U	1.1	U
86306	N-Nitrosodiphenylamine	0.42	U	0.44	U	0.43	U	0.44	U
101553	4-Bromophenyl-phenylether	0.42	U	0.44	U	0.43	U	0.44	U
118741	Hexachlorobenzene	0.42	U	0.44	U	0.43	U	0.44	U
87865	Pentachlorophenol	1	U	1.1	U	1	U	1.1	U
85018	Phenanthrene	0.42	U	0.44	U	0.43	U	0.0025	J
120127	Anthracene	0.42	U	0.44	U	0.43	U	0.44	U
86748	Carbazole	0.42	U	0.44	U	0.43	U	0.44	U
84742	Di-n-butylphthalate	0.0047	J	0.44	U	0.43	U	0.44	U
206440	Fluoranthene	0.42	U	0.44	U	0.43	U	0.0035	J
129000	Pyrene	0.42	U	0.44	U	0.43	U	0.0029	J
85687	Butylbenzylphthalate	0.42	U	0.44	U	0.43	U	0.44	U
91941	3,3'-Dichlorobenzidine	0.42	U	0.44	U	0.43	U	0.44	U
56553	Benzo(a)anthracene	0.42	U	0.44	U	0.43	U	0.0058	J
218019	Chrysene	0.42	U	0.44	U	0.43	U	0.0112	J
117817	bis(2-Ethylhexyl)phthalate	0.17	B	0.28	B	0.21	B	0.068	B
117840	Di-n-octylphthalate	0.13	B	0.31	B	0.2	B	0.028	B
205992	Benzo(b)fluoranthene	0.42	U	0.44	U	0.43	U	0.0026	J
207089	Benzo(k)fluoranthene	0.42	U	0.44	U	0.43	U	0.0026	J
50328	Benzo(a)pyrene	0.42	U	0.44	U	0.43	U	0.0024	J
193395	Indeno(1,2,3-cd)pyrene	0.42	U	0.44	U	0.43	U	0.44	U
53703	Dibenz(a,h)anthracene	0.42	U	0.44	U	0.43	U	0.44	U
191242	Benzo(g,h,i)perylene	0.42	U	0.44	U	0.43	U	0.44	U

Note 1: "J" qualified data has been adjusted in accordance with OSWER Directive 9285.7-14FS, "Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Sediment Sample Summaries - U.S. EPA CLP
Nitroaromatics and Mustard Decomp. Analyses Data Sheet**

Site Name: Penniman Shell Loading Plant

All units in mg/kg

Sample ID No.	PEN1-SED-01		PEN1-SED-02		PEN1-SED-02A		PEN1-SED-04		PEN1-SED-05		PEN1-SED-06		PEN1-SED-07		PEN1-SED-08	
Compound	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
HMX	2.2	U	22	U	22	U	220	U	2.2	U	2.2	U	2.2	U	2.2	U
1,3,5-Trinitrobenzene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U	0.25	U
RDX	1.0	U	10	U	10	U	100	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dinitrobenzene	0.25	U	2.5	U	2.5	U	25.00	U	0.25	U	0.25	U	0.25	U	0.25	U
Nitrobenzene	0.26	U	2.6	U	2.6	U	26	U	0.26	U	0.26	U	0.26	U	0.26	U
2,4,6-Trinitrotoluene	0.25	U	0.25		0.25		0.25		0.25	U	0.25	U	0.25	U	0.25	U
Tetryl	0.65	U	6.5	U	6.5	U	65	U	0.65	U	0.65	U	0.65	U	0.65	U
2,4-Dinitrotoluene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U	0.25	U
2,6-Dinitrotoluene	0.26	U	2.6	U	2.6	U	26	U	0.26	U	0.26	U	0.26	U	0.26	U
2-Amino-4,6-dinitrotoluene	0.25	U	1.8	J	1.8	U	18	U	0.25	U	0.25	U	0.25	U	0.25	U
4-Amino-2,6-dinitrotoluene	0.25	U	1.4	B	1.1	B	11	B	0.25	U	0.25	U	0.25	U	0.25	U
2-Nitrotoluene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U	0.25	U
4-Nitrotoluene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U	0.25	U
3-Nitrotoluene	0.25	U	2.5	U	2.5	U	25	U	0.25	U	0.25	U	0.25	U	0.25	U
Bis(2-chloroethyl) sulfide (HD)	NA		NA		NA		NA		NA		NA		NA		NA	
1,4-Dithiane	NA		NA		NA		NA		NA		NA		NA		NA	
1,4-Oxathiane	NA		NA		NA		NA		NA		NA		NA		NA	

Note 1: NA in results column indicates that this compound was not analyzed for in the sample.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Sediment Sample Summaries - U.S. EPA CLP
Nitroaromatics and Mustard Decomp. Analyses Data Sheet**

Site Name: Penniman Shell Loading Plant

All units in mg/kg

Sample ID No.	PEN1-SO-09		PEN1-SO-10		PEN1-SO-11		PEN1-SO-12		PEN1-SO-13		PEN1-SO-14	
Compound	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
HMX	2.2	U	2.2	U	2.2		2.2		2.2		2.2	
1,3,5-Trinitrobenzene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
RDX	1.0	U	1.0	U	1.0		1.0		1.0		1.0	
1,3-Dinitrobenzene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
Nitrobenzene	0.26	U	0.26	U	0.26		0.26		0.26		0.26	
2,4,6-Trinitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
Tetryl	0.65	U	0.65	U	0.65		0.65		0.65		0.65	
2,4-Dinitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
2,6-Dinitrotoluene	0.26	U	0.26	U	0.26		0.26		0.26		0.26	
2-Amino-4,6-dinitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
4-Amino-2,6-dinitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
2-Nitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
4-Nitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
3-Nitrotoluene	0.25	U	0.25	U	0.25		0.25		0.25		0.25	
Bis(2-chloroethyl) sulfide (HD)	0.02	U	0.02	U	NA		NA		NA		NA	
1,4-Dithiane	0.02	U	0.02	U	NA		NA		NA		NA	
1,4-Oxathiane	0.02	U	0.02	U	NA		NA		NA		NA	

Note1: NA in results column indicates that this compound was not analyzed for in the sample.

Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

**Site Surface Water Sample Summaries - U.S. EPA CLP
Inorganic Analysis Data Sheet**

Site Name: Penniman Shell Loading Plant

All units in ug/L

CAS#	Sample ID No.	PEN1-SW-01		PEN1-SW-01A		PEN1-SW-02	
	Compound	Results	Q	Results	Q	Results	Q
7429905	Aluminum	401	-	458	-	39.5	B
7440360	Antimony		UL		UL		UL
7440382	Arsenic		-		-	4	-
7440393	Barium	30.2	-	34.6	-	18.6	-
7440417	Beryllium		-		-		-
7440439	Cadmium	0.35	-		-		-
7440702	Calcium	61600	-	68000	-	50400	-
7440473	Chromium	1.5	-	0.73	-		-
7440484	Cobalt		-		-		-
7440508	Copper	69.75	J	82.75	J	1.3	B
7439896	Iron	1330	-	1720	-	145	-
7439921	Lead	2.5	B	5.9	B		UJ
7439954	Magnesium	1840	-	1960	-	2100	-
7439965	Manganese	105	-	145	-	13.5	-
7439976	Mercury		-		-		-
7440020	Nickel		-		-		-
7440097	Potassium	2010	-	2320	-	2900	-
7782492	Selenium		-		-		-
7440224	Silver		-		-		-
7440235	Sodium	6290	-	6670	-	11500	-
7440280	Thallium		-		-		-
7440622	Vanadium		-	1.4	-		-
7440666	Zinc	18	B	21.2	B	2.2	B
74908	Cyanide		UL		UL		UL

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"Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994

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**Site Surface Water Sample Summaries - U.S. EPA CLP
Pesticide/Polychlorinated Biphenyl Analysis Data Sheet**

Site Name: Penniman Shell Loading Plant

All units in ug/L

CAS#	Sample ID No. Compound	PEN1-SW-01		PEN1-SW-01A		PEN1-SW-02	
		Results	Q	Results	Q	Results	Q
319846	alpha-HCH	0.05	U	0.05	U	0.05	U
319857	beta-HCH	0.011	B	0.006	B	0.05	U
319868	delta-HCH	0.05	U	0.05	U	0.05	U
58899	gamma-HCH (Lindane)	0.05	U	0.05	U	0.05	U
76448	Heptachlor	0.008	B	0.012	B	0.01	B
309002	Aldrin	0.05	U	0.05	U	0.05	U
1024573	Heptachlor epoxide	0.05	U	0.05	U	0.05	U
959988	Endosulfan I	0.05	U	0.05	U	0.05	U
60571	Dieldrin	0.1	U	0.1	U	0.1	U
72559	4,4'-DDE	0.1	U	0.1	U	0.1	U
72208	Endrin	0.1	U	0.1	U	0.1	U
33213659	Endosulfan II	0.1	U	0.1	U	0.1	U
72548	4,4'-DDD	0.1	U	0.1	U	0.1	U
1031078	Endosulfan sulfate	0.1	U	0.1	U	0.1	U
50293	4,4'-DDT	0.1	U	0.1	U	0.1	U
72435	Methoxychlor	0.5	U	0.5	U	0.5	U
53494705	Endrin ketone	0.1	U	0.1	U	0.1	U
7421363	Endrin aldehyde	0.1	U	0.1	U	0.1	U
5103719	alpha-Chlordane	0.05	U	0.05	U	0.05	U
5103742	gamma-Chlordane	0.05	U	0.05	U	0.05	U
8001352	Toxaphene	5	U	5	U	5	U
12674112	Aroclor-1016	1	U	1	U	1	U
11104282	Aroclor-1221	2	U	2	U	2	U
11141165	Aroclor-1232	1	U	1	U	1	U
53469219	Aroclor-1242	1	U	1	U	1	U
12672296	Aroclor-1248	1	U	1	U	1	U
11097691	Aroclor-1254	1	U	1	U	1	U
11096825	Aroclor-1260	1	U	1	U	1	U

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"Using Qualified Data to Document an Observed Release - Quick Reference Fact Sheet" July 1994
Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in
accordance with HRS criteria.

**Site Surface Water Sample Summaries - U.S. EPA CLP
Volatile Organic Analysis Data Sheet**

Site Name: Penniman Shell Loading Plant

All units in ug/L

CAS#	Sample ID No.	PEN1-SW-01		PEN1-SW-01A		PEN1-SW-02	
	Compound	Results	Q	Results	Q	Results	Q
74873	Chloromethane	10	---	10	U	10	U
74839	Bromomethane	10	---	10	U	10	U
75014	Vinyl chloride	10	---	10	U	10	U
75003	Chloroethane	10	---	10	U	10	U
75092	Methylene chloride	10	---	10	U	10	U
67641	Acetone	10	---	10	U	10	U
75150	Carbon disulfide	10	---	10	U	10	U
75354	1,1-Dichloroethene	10	---	10	U	10	U
75343	1,1-Dichloroethane	10	---	10	U	10	U
540590	1,2-Dichloroethene (total)	10	---	10	U	10	U
67663	Chloroform	10	---	10	U	10	U
107062	1,2-Dichloroethane	10	---	10	U	10	U
78933	2-Butanone (MEK)	10	---	10	U	10	U
71556	1,1,1-Trichloroethane	10	---	10	U	10	U
56235	Carbon tetrachloride	10	---	10	U	10	U
75274	Bromodichloromethane	10	---	10	U	10	U
78875	1,2-Dichloropropane	10	---	10	U	10	U
542756	1,3-Dichloropropene	10	---	10	U	10	U
79016	Trichloroethene	10	---	10	U	10	U
124481	Dibromochloromethane	10	---	10	U	10	U
79005	1,1,2-Trichloroethane	10	---	10	U	10	U
71432	Benzene	10	---	10	U	10	U
75252	Bromoform	10	---	10	U	10	U
108101	4-Methyl-2-pentanone	10	---	10	U	10	U
591786	2-Hexanone	10	---	10	U	10	U
127184	Tetrachloroethene	10	---	10	U	10	U
79345	1,1,2,2-Tetrachloroethane	10	---	10	U	10	U
108883	Toluene	10	---	10	U	10	U
108907	Chlorobenzene	10	---	10	U	10	U
100414	Ethylbenzene	10	---	10	U	10	U
100425	Styrene	10	---	10	U	10	U
1330207	Xylene (total)	2	U	10	U	10	U

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 Note 2: Data highlighted in bold indicates chemical concentrations exceeding background levels in accordance with HRS criteria.

Site Surface Water Sample Summaries - U.S. EPA CLP

Semi-Volatile Organic Analysis Data Sheet

Site Name: Penniman Shell Loading Plant

All units in ug/L

CAS#	Sample ID No. Compound	PEN1-SW-01		PEN1-SW-01A		PEN1-SW-02	
		Results	Q	Results	Q	Results	Q
108952	Phenol	10	U	10	U	10	U
111444	bis(2-Chloroethyl) ether	10	U	10	U	10	U
95578	2-Chlorophenol	10	U	10	U	10	U
541731	1,3-Dichlorobenzene	10	U	10	U	10	U
106467	1,4-Dichlorobenzene	10	U	10	U	10	U
95501	1,2-Dichlorobenzene	10	U	10	U	10	U
95487	2-Methylphenol	10	U	10	U	10	U
108601	2,2'-oxybis(1-Chloropropane)	10	U	10	U	10	U
106445	4-Methylphenol	10	U	10	U	10	U
621647	N-Nitroso-di-n-propylamine	10	U	10	U	10	U
67721	Hexachloroethane	10	U	10	U	10	U
98953	Nitrobenzene	10	U	10	U	10	U
78591	Isophorone	10	U	10	U	10	U
88755	2-Nitrophenol	10	U	10	U	10	U
105679	2,4-Dimethylphenol	10	U	10	U	10	U
111911	bis(2-Chloroethoxy) methane	10	U	10	U	10	U
120832	2,4-Dichlorophenol	10	U	10	U	10	U
120821	1,2,4-Trichlorobenzene	10	U	10	U	10	U
91203	Naphthalene	10	U	10	U	10	U
106478	4-Chloroaniline	10	U	10	U	10	U
87683	Hexachlorobutadiene	10	U	10	U	10	U
59507	4-Chloro-3-methylphenol	10	U	10	U	10	U
91576	2-Methylnaphthalene	10	U	10	U	10	U
77474	Hexachlorocyclopentadiene	10	U	10	U	10	U
88062	2,4,6-Trichlorophenol	10	U	10	U	10	U
95954	2,4,5-Trichlorophenol	25	U	25	U	25	U
91587	2-Chloronaphthalene	10	U	10	U	10	U
88744	2-Nitroaniline	25	U	25	U	25	U
131113	Dimethylphthalate	10	U	10	U	10	U
208968	Acenaphthylene	10	U	10	U	10	U
606202	2,6-Dinitrotoluene	10	U	10	U	10	U
99092	3-Nitroaniline	25	U	25	U	25	U
83329	Acenaphthene	10	U	10	U	10	U

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**Site Surface Water Sample Summaries - U.S. EPA CLP
Semi-Volatile Organic Analysis Data Sheet (continued)**

Site Name: Penniman Shell Loading Plant

All units in ug/L

CAS#	Sample ID No. Compound	PEN1-SW-01		PEN1-SW-01A		PEN1-SW-02	
		Results	Q	Results	Q	Results	Q
51285	2,4-Dinitrophenol	25	U	25	U	25	U
100027	4-Nitrophenol	25	U	25	U	25	U
132649	Dibenzofuran	10	U	10	U	10	U
121142	2,4-Dinitrotoluene	10	U	10	U	10	U
84662	Diethylphthalate	10	U	10	U	10	U
7005723	4-Chlorophenyl-phenylether	10	U	10	U	10	U
86737	Fluorene	10	U	10	U	10	U
100016	4-Nitroaniline	25	U	25	U	25	U
534521	4,6-Dinitro-2-methylphenol	25	U	25	U	25	U
86306	N-Nitrosodiphenylamine	10	U	10	U	10	U
101553	4-Bromophenyl-phenylether	10	U	10	U	10	U
118741	Hexachlorobenzene	10	U	10	U	10	U
87865	Pentachlorophenol	25	U	25	U	25	U
85018	Phenanthrene	10	U	10	U	10	U
120127	Anthracene	10	U	10	U	10	U
86748	Carbazole	10	U	10	U	10	U
84742	Di-n-butylphthalate	10	U	10	U	10	U
206440	Fluoranthene	10	U	10	U	10	U
129000	Pyrene	10	U	10	U	10	U
85687	Butylbenzylphthalate	10	U	10	U	10	U
91941	3,3'-Dichlorobenzidine	10	U	10	U	10	U
56553	Benzo(a)anthracene	10	U	10	U	10	U
218019	Chrysene	10	U	10	U	10	U
117817	bis(2-Ethylhexyl)phthalate	10	U	10	U	10	U
117840	Di-n-octylphthalate	10	U	10	U	10	U
205992	Benzo(b)fluoranthene	10	U	10	U	10	U
207089	Benzo(k)fluoranthene	10	U	10	U	10	U
50328	Benzo(a)pyrene	10	U	10	U	10	U
193395	Indeno(1,2,3-cd)pyrene	10	U	10	U	10	U
53703	Dibenz(a,h)anthracene	10	U	10	U	10	U
191242	Benzo(g,h,i)perylene	10	U	10	U	10	U

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ATTACHMENT 3
PHOTOGRAPH LOG

Penniman Shell Loading Plant
Photograph Log

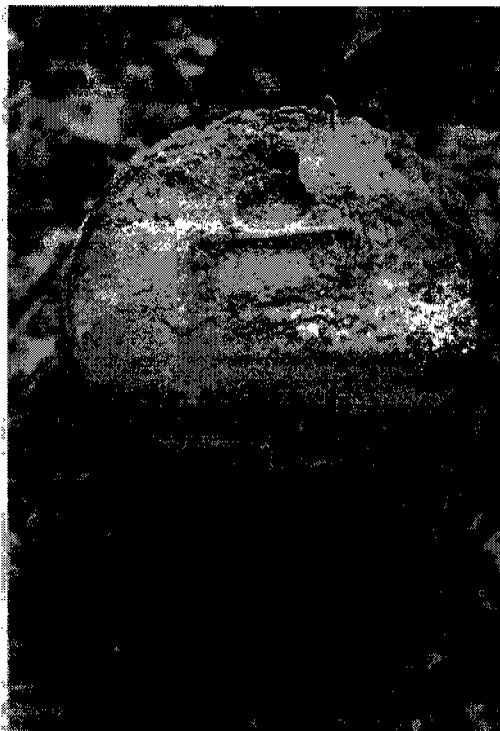


Photograph 1. September 1998.
One of two cylinders found at Jones Pond landfill area.



Photograph 2. September 1998.
An overview of one of the cylinders found at Jones Pond landfill area.

Penniman Shell Loading Plant
Photograph Log



Photograph 3. September 1998.
A black powder drum found at Jones Pond landfill area.



Photograph 4. September 1998.
The oozing drum found at the Jones Pond landfill area.

Penniman Shell Loading Plant
Photograph Log



Photograph 5. September 1998.
The underground "mixing tank" found in the shipping house portion of the property.



Photograph 6. September 1998.
The shallow ditch containing 3-inch steel pipes near the shipping house area.

Penniman Shell Loading Plant
Photograph Log



Photograph 7. September 1998.
A typical example of the blast holes found in the magazine area.



Photograph 8. September 1998.
The FM/FS smoke drum found in the magazine area

Penniman Shell Loading Plant
Photograph Log



Photograph 9. September 1998.
A typical example of the remains of the nitro-starch house bunkers.



Photograph 10. September 1998.
A "mixing tank" found above ground in the shipping house area.

ATTACHMENT 4
CHRONOLOGY OF EVENTS
(JANUARY 1999 SAMPLING EVENT)

Penniman Shell Loading Plant
Chronology of Events

CHRONOLOGY OF EVENTS

The following is a chronological summary of the site sampling event conducted between 11 and 14 January 1999. Representatives from SATA, United States Navy Atlantic Division (USN LANTDIV), USN Weapons Station Yorktown (USN WSY), USN Cheatham Annex (USN CAX), USN Fleet and Industrial Supply Center Norfolk (FISC), and the Virginia Department of Environmental Quality (VADEQ) were present on site during this sampling event.

Monday, 11 January 1999

At approximately 1430 hours, SATA members Robert McGlade, Melissa Conklin, and Michelle Fay met on site at building 250 with USN LANTDIV Schirmer, USN CAX Folson, USN WSY Harlow, USN WSY Neill, and VADEQ Wilcox for a briefing of the anticipated sampling activities.

Tuesday, 12 January 1999

At approximately 0700 hours, SATA members R. McGlade, M. Biswas, M. Conklin, M. Fay, and P. Davis arrived on site to begin sampling and mapping activities. SATA members McGlade and Biswas began mapping operations and SATA members Conklin, Fay, and Davis began sampling activities according to the EPA approved sampling plan for the site.

USN CAX personnel made arrangements to have underground utilities marked around Building 113 prior to the collection of two sub-surface soil samples by SATA near that location.

USN FISC B. Conner and VADEQ Wilcox were on site to observe the sampling activities. USN LANTDIV Schirmer and USN WSY Harlow and Neill were on site to reconnoiter the sampling areas.

The SATA sampling crew was unable to collect sample PEN1-SO-02 from inside of the ammonia evaporating building ruins. These ruins consisted of a brick structure approximately 6 feet by 6 feet by 12 feet tall. There was no suitable access to the interior of this structure as originally expected, and therefore this sample could not be collected.

Wednesday, 13 January 1999

At approximately 0700 hours, SATA members R. McGlade, M. Biswas, M. Conklin, M. Fay, and P. Davis arrived on site to continue sampling and mapping activities.

The SATA sampling crew was unable to collect soil sample PEN1-SO-08, as no representative soil could be located in this area. This area consisted of steel and concrete debris covered with a thin layer of detritus. Since no representative soil could be located in this area, this sample was not collected. The material contained in this drum appeared to be cosmaline, which is a Vaseline-like material used to prevent the corrosion of metals.

Penniman Shell Loading Plant
Chronology of Events

SATA members McGlade and Biswas met with USN CAX Ranger Butch Hogg, USN LANTDIV Schirmer, USN WSY Harlow, and USN WSY Neill at the Ranger Station on base to discuss sampling activities and historical site information. USN CAX Ranger Butch Hogg informed SATA of the following information:

- The FM/FS smoke drum currently located in the magazine area has been moved several times over the years.
- As recently as last year, Mr. Hogg had spoken to an elderly gentlemen residing in the area who actually worked at the Penniman plant when he was a small boy (~10 years old).
- The slag material found throughout the site was believed to be coal slag broken out of the steam locomotive boilers and discarded by train engineers.

SATA members McGlade and Biswas could not locate the 3-inch steel pipes found during the 15 September site reconnaissance that were targeted for mapping.

SATA members McGlade and Biswas made attempts to isolate shell fragments from three of the blast holes in the magazine area as recommended by the WESTON ordnance expert. No shell fragments could be found using a ½-inch mesh archaeological soil sieve. One railroad spike was found in one of the three blast holes, one railroad spike and one railroad rail were found in the second blast holes, and a large metal railroad item was found in the third blast hole. No other metal items were found in these blast holes. Excavation activities in these blast holes was conducted by hand to approximately 12-inches below the floor level. SATA noted that these holes were covered with approximately 4 to 6 inches of humus and detritus, below which lay "clean" sand.

Sample PEN1-SO-14, collected from the waste drum storage area identified in 1918 drawings, was collected from a depth of 18 to 24 inches. This modification was made to the sampling plan (which specified a depth of 24 to 36 inches) in consideration of the applicability of the sample for CERCLA SI purposes.

SATA completed sampling activities at approximately 1730 hours and began packing the samples in preparation for shipment.

Thursday, 14 January 1999

As the result of a threatening ice storm and in concern for the timely shipment of samples to the laboratories, SATA demobilized from the site at 0645 hours. SATA prepared and shipped all samples for medium concentration organic analysis, medium concentration inorganic analysis, and low concentration inorganic analysis to the laboratories assigned by the EPA. The samples for mustard screening and nitroaromatics analysis could not be shipped because laboratories had not yet been assigned by the EPA. These samples were secured at the SATA office in Delran, New Jersey until assignment of these laboratories.

Penniman Shell Loading Plant
Chronology of Events

Tuesday, 19 January 1999

SATA received the laboratory assignments for the samples requiring mustard screening and the samples requiring nitroaromatics analyses. These samples were prepared and shipped to the laboratories for analysis.

Wednesday, 20 January 1999

SATA members McGlade and Fay began the nitroaromatics field screening for the samples so targeted.

Thursday, 21 January 1999

SATA members McGlade and Fay completed the nitroaromatics field screening for the samples so targeted.